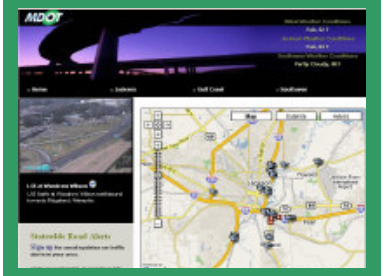

MDOT
MISSISSIPPI DEPARTMENT OF TRANSPORTATION

MISSISSIPPI INTELLIGENT TRANSPORTATION SYSTEM CONCEPT OF OPERATIONS

MDOT-ITS 004-01-001

Prepared by:

URS Corporation
Gresham, Smith and Partners, MS, P.C.

January 2008

FHWA
MISSISSIPPI
DIVISION OFFICE

MISSISSIPPI INTELLIGENT TRANSPORTATION SYSTEM CONCEPT OF OPERATIONS

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FINAL DRAFT

Prepared for:

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TABLE OF CONTENTS

1. Scope

"MDOT will use ITS technologies to improve the quality of life for State residents and visitors by providing more reliable, informative, safer and flexible passenger and freight multi-modal transportation services."

1.1 Document Overview

This document will serve as the Concept of Operations for the Mississippi Department of Transportation (MDOT) Statewide Intelligent Transportation System (ITS). The content of this document was developed in accordance with the Federal Highway Administration and Federal Transit Administration documents, *Transportation Management Center Concepts of Operations - Implementation Guide, December 1999* and *Developing and Using a Concept of Operations in Transportation Management Systems,* an *FHWA Pooled Fund Study, December 2004.* For the purposes of the development of this Concept of Operations, a ten (10) year horizon was assumed and this concept is representative of potential ITS development by MDOT during that time horizon.

1.2 Document Contents

This document provides the foundation for the development of the ITS system requirements and all other steps in the life-cycle of the ITS hardware and software system and provides for the traceability needed to insure satisfactory development, operations and maintenance of the system. The following is a listing of the sections which have been included in this document:

- Reference Documents

This section lists the documents used to develop the overall concept for ITS in Mississippi and other documents related to business functions, standard operational procedures and other references that effect the development of ITS statewide.

- Existing System(s) and Processes

This section provides a brief description of the existing ITS systems and deployments in the state. It briefly describes the relationships between current users and operators of ITS in the state.

- Proposed System Concept

This section focuses on the objectives to meet identified operational needs and the services that ITS will provide. It outlines the MDOT organizational structure and presents a high level system description and identification of the stakeholders of the system. It describes policies which may require review or revision and other factors that may constrain system development. It also describes the basic system support and maintenance concept.

- User System Relationships and Privileges

This section describes each user class of the system and their relationships and privileges relative to the system operations. It explains the operations of the various aspects of the system and describes the activities of the various user classes.

- System Overview

This section describes the user interfaces and functional flows of the system utilizing both textual descriptions and market package diagrams tailored to MDOT.

- Implementation, Operation and Support Environment

This section describes the environment in which the system will operate and includes information regarding the resources and services the system needs to function.

- Operational Scenarios

This section includes three sample ITS scenarios that illustrate how the ITS system operates in real-world situations. These scenarios cover several of the market packages described in the Concept.

1.3 Document Audience

The audience for this document includes the following individuals and groups:

- MDOT Management responsible for establishing Department policy and funding allocations.

- Department personnel involved in transportation systems operations and construction and maintenance activities that would interact with the system by providing information to or receiving information from the system.

- MDOT Operations personnel responsible for the monitoring and control of freeway and surface transportation facilities.

- Information Systems personnel responsible for administration, operations and maintenance of Information Technology (IT) systems of the Department.

- Other state and local agencies that will interact with the MDOT system by providing information to or receiving information from the system.

- Entities outside of government such as the broadcast media and Information Service Providers (ISP), who provide information to travelers as well as towing and recovery operators involved in incident response and clearance.

- MDOT selected software system developers who will identify the functional requirements of the software, and those who will design, build, operate and maintain the system.

1.4 System Vision

MDOT's ITS Mission, as stated in the original Statewide ITS Strategic Plan, is:

"MDOT will use ITS technologies to improve the quality of life for State residents and visitors by providing more reliable, informative, safer and flexible passenger and freight multi-modal transportation services."[1]

1.5 Overarching Goals and Objectives for the System

The goals for the Mississippi Statewide ITS were set forth in the original Statewide ITS Strategic Plan, and were accepted as the overarching goals of the Statewide Architecture. These goals are as follows:

- Provide more timely and useful traveler information;
- Enhance motorist safety;
- Improve hurricane evacuation coordination;
- Provide more effective incident management; and
- Manage traffic during and after construction activities.

Eight objectives were established for the Mississippi Statewide ITS Architecture, including:

- Establish an ITS architecture that is open, receptive and adaptable; is consistent with developing national standards; provides opportunities for private/public partnerships; and encourages and supports interagency cooperation.

- Develop and integrate traveler information, traffic management, transit management, maintenance and construction management, emergency management systems, archived data management and electronic payment throughout Mississippi as appropriate.

- Define how information is collected, processed, distributed and disseminated.

- Define interfaces and information flow among/between subsystems, agencies and users.

[1] Mississippi Department of Transportation ITS Strategic Plan, Wilbur-Smith and Associates, 2002.

- Support the transportation planning process for ITS projects for the DOT and MPOs.
- Support development of strategies and actions in the planning process that lead to an integrated, efficient intermodal transportation system.
- Support the development of ITS projects.
- Assist in developing, prioritizing and addressing consistency of proposed transportation investment.

1.6 Purpose for System Implementation

MDOT recognizes the benefits that will be derived from the development and operations of ITS, many of which have been documented through benefits analysis of ITS in other states. Examples include:

- In and around the *Houston Astrodome*, freeway management applications resulted in a reduction of congestion by an estimated 46%.
- In *Denver, CO*, Dynamic Message Signs (DMSs) that displayed real-time vehicle emission levels motivated most motorists surveyed to consider repairs.
- In *Pennsylvania*, Traffic and Incident Management Systems (TIMS) decreased secondary incidents on highways 40% between 1993 and 1997.
- In *Minnesota*, a $600K/yr Highway Helper Program reduced the average duration of stall incidents by 8 minutes, saving $1.4 million/yr in delay costs.
- In the *Washington, DC* metro area, a simulation model estimated that commuters who used traveler information improved their on-time reliability 5-16%.
- In *Georgia* the incident management program reduced secondary crashes in the NaviGAtor coverage area by 69 percent. It was estimated that the secondary crash rate was reduced from 676 to 210 crashes annually. Additionally, the program resulted in an average 46-minute reduction in incident duration time and reduced incident delay by 7.25 million vehicle-hours per year. In the Georgia NaviGAtor coverage area, the value of HERO motorist assistance resulted in a cost savings of more than 187 million dollars, which was used to calculate a benefit-to-cost ratio of 4.4:1.

MDOT is expanding and improving services to its customers by using ITS technologies and strategies to improve management and operations of the transportation system. The ITS technologies and strategies include improved transportation surveillance, control strategies, information dissemination, incident and emergency response and more effective and efficient utilization of equipment and human resources. To meet the demands on the Mississippi transportation network an improved system capable of providing centralized coordination, control and monitoring is needed. Implementation of this system will improve existing transportation system operations and performance and will provide the foundation for future improvements as additional technologies are integrated.

Given that the vast majority of freeway miles in Mississippi are outside of urban areas, rural ITS implementations will be needed. In areas of the state below I-20, hurricane evacuations require a cadre of ITS tools and a good working relationship with the Mississippi Emergency Management Agency (MEMA). Currently, contra-flow is established on I-55 and I-59 coming out of New Orleans by law-enforcement when requested by Louisiana. Additional ITS tools, such as portable DMS, will be employed in advance of evacuations and must be portable and communicate over a wireless network. They may also need an alternative power supply such as solar or generator power. Please refer to the Mississippi Hurricane Evacuation Guide (http://www.gomdot.com/Home/cetrp/hurricane_evacuation_guide_021607.pdf) for more information.

MDOT Roadway Assistance is not anticipated to be implemented in rural areas of the state. This role will be continued to be played by the Mississippi Highway Patrol with assistance from local towing services and other task-specific responders. Construction Work Zones are a significant source of vehicle delay (often irregular and unanticipated). Along freeways, portable DMS and portable CCTV may be employed in tandem with broadcasting details of the work zone on the MSTraffic.com traveler information web site. In the future, each of the above Rural ITS tools will be driven by 511, given that the mechanisms are in place for relevant traveler information on incidents and conditions are submitted to MDOT in real-time.

(Roadway Assistance in Georgia)

The need to provide better and more time sensitive information to travelers has been identified as a major benefit in congestion management, incident management and in the event of major man-made and natural disasters. ITS will provide not only the means to gather relevant data and information but the means to disseminate that information in a much more timely and effective manner. This will benefit travelers in avoiding congestion and incidents as well as regulating in-route choices during evacuations and other events having broad impact on the transportation system.

On surface streets, one potential ITS benefit is the ability to maintain inter-connected signals. Having signals inter-connected to a central signal control system at a TOC or TMC gives operators the ability to make real-time, situation-related changes to signal timing on multiple signals. In addition, having inter-connected signals for normal operation promotes the optimization of signal phasing for each intersection.

Operational improvements related to surface street control and freeway control have also been identified as needs. The ability to monitor the facilities, gather timely operational data and utilize that data to affect the operation of the facility, in near real-time, will provide more efficient traffic flow and clear incidents more quickly. This will result in savings in fuel, time and overall cost to travelers as well as to the agencies using ITS.

Improvement in the utilization of MDOT resources may also be realized by the installation of ITS. Department personnel will be able to monitor roadway environmental conditions remotely, rather than through the dispatch of personnel and equipment to perform the monitoring functions. Response to fog, flooding and other weather conditions will be more efficient because the appropriate resources can be dispatched based upon the system acquired data, saving man hours, fuel and materials. Incidents will be detected and monitored by the ITS and the appropriate MDOT resources will be dispatched for the type of clean-up and support required. This will result in savings in management oversight time and the utilization of only those MDOT resources necessary to handle the incident clean-up activities.

1.7 Scope Boundaries of the System

This document serves as the concept for the ITS within MDOT and the physical boundaries of the system include the entire State of Mississippi. This concept is developed for the MDOT ITS; therefore, it is conceptually bound by those transportation related functions under the direct operational control of MDOT. Operations and data flows outside of the direct control of MDOT are shown in the Statewide ITS Architecture to clarify the operational characteristics of the MDOT ITS. These data flows do not dictate how others outside of MDOT will operate but they do indicate the external interfaces that MDOT desires.

2. Reference Documents

"Architecture documentation is the foundation step in the completion of a successful systems engineering process for any ITS system."

Documents that have been utilized in the development of this Concept of Operations document include the following:

2.1 Studies Identifying Operational Needs

Mississippi DOT MULTIPLAN, September 2001 - MULTIPLAN is the Long Range Transportation Plan for the Mississippi Department of Transportation. The Mississippi ITS Strategic Plan is incorporated into MULTIPLAN. The ITS Strategic Plan is a consensus based approach that provides the framework for ITS planning and project development within the State of Mississippi. The following four documents are part of the MULTIPLAN and have been used in the development of the Concept of Operations:

- "Jackson Urbanized Area 2030 Transportation Plan" - On May 26, 2005, the Metropolitan Planning Organization (MPO) approved final year 2030 projections of population, housing, employment and school enrollment for the area expected to become urban in character by 2030. These projections were performed as part of the statewide MULTIPLAN, which includes the 2030 Jackson Urbanized Area Transportation Plan.

- "Mississippi Gulf Coast Urbanized Area 2025 Transportation Plan" - This document is a specific discussion of ITS plans and needs for the Gulf Coast Urbanized Region of Mississippi through the year 2025. It is one of four regions across Mississippi with a specific document related to just that region of the state. The plan was developed by a consultant with much input from the Transportation Policy Committee (TPC) that includes representatives from the Gulf Region local government and planning agencies.

- "Hattiesburg-Petal-Forrest-Lamar Metropolitan Planning Organization 2001 Transportation Plan" - The 2001 Transportation Plan is an update of the Transportation Plan completed for the Hattiesburg-Petal-Forrest-Lamar Metropolitan Planning Organization (HPFL-MPO) in 1996 and is included in the MULTIPLAN Phase I. The objective of the 2001 Transportation Plan is to present practical information and recommendations that will improve the transportation facilities and guide the development of the transportation program for the MPO.

- "Comprehensive Emergency Transportation Response Plan (CETRP)" – The CETRP is based on the concept that the functions of the various governmental agencies, commissions and departments of the state, county and municipal levels during emergencies will parallel generally their normal day-to-day functions employing as far as possible the same personnel and material resources in both cases.

The operational concepts upon which this plan is based are applicable to both natural and manmade disasters. This plan is used in times of large scale emergencies that cross multiple local government agency and emergency management service boundaries.

2.2 Other Reference Documents

National ITS Architecture Version 5.1 - The National ITS Architecture provides a common framework for planning, defining and integrating intelligent transportation systems. The architecture defines:

- The functions (e.g., gather traffic information or request a route) that are required for ITS.

- The physical entities or subsystems where these functions reside (e.g., the field or the vehicle).

- The information flows and data flows that connect these functions and physical subsystems together into an integrated system.

NOTE: Version 6.0 of the architecture became available in 2007 after the work on the Concept of Operations was mostly complete. The new version of the architecture has not been shown to cause any changes or additions to this document as of the publication date.

2.3 Mississippi ITS Architecture Documents

The development of the architecture, for any system, is the foundation for the system and provides the overall view of the ultimate system as it is envisioned by the system stakeholders. Architectures are unrestrained and provide a system vision that is not bounded by available human resources, costs, technological capabilities, policies or other constraints which will ultimately affect the project development aspects for the system. Architecture documentation is a pre-cursor to the development of the Concept of Operation documentation, providing the foundation for the concepts to be implemented at the statewide and project level. Architecture documentation is the foundation step in the completion of a successful systems engineering process for any ITS system.

MDOT is developing a statewide and four regional architectures to insure that varying geographic considerations as well as demographic differences are recognized and included in the total ITS systems vision. The Statewide and Gulf Regional Architectures

are complete and the Central Regional Architecture is nearing completion. The Regional Architecture for the Hattiesburg Region began in September 2007 and the Northwest Region Architecture is planned. MDOT will continue an architecture maintenance plan to keep the architecture documents up-to-date.

The completed Statewide and Gulf Coast Regional architectures contain information on ITS needs and specific Market Package information has been extracted from these completed architecture documents for use in developing this Concept of Operations. The following describe the two architecture documents that were used as reference documentation:

Mississippi Statewide ITS Architecture, March 2007

The Mississippi Statewide Intelligent Transportation Systems (ITS) Architecture is a roadmap for intelligent transportation systems deployment and integration in the State of Mississippi. It describes the "big picture" for ITS deployment of transportation and ITS projects that address the transportation problems and needs. The Statewide Architecture includes services that are of a statewide nature and it also provides guidance for the areas of the state that are not covered by one of the other Regional Architectures.

Mississippi Gulf Region ITS Architecture, April 2007

The Mississippi Gulf Region Intelligent Transportation System (ITS) Architecture is a framework for ITS deployment and integration in the Mississippi Gulf Coast region. The purpose of the Gulf Region Intelligent Transportation System Architecture is to provide a "road map" for the deployment of ITS programs and projects in the Gulf Coast region over the next 20 years. The Gulf Region ITS Architecture specifically concentrates on the ITS components planned for the Gulf Coast region.

The Gulf Region ITS Architecture has been developed by MDOT in conjunction with the Gulf Regional Planning Commission (GRPC) and various stakeholders in the Mississippi Gulf Coast region.

2.4 System Integrator Contract - Project Documentation

MDOT anticipates that the current Systems Integrator Contract will be a long-term relationship between MDOT and the consultants. This contract includes revisions to the Statewide and Regional ITS Architectures and has been used to facilitate the development of this Concept of Operations. The Systems Integrator Contract has tasks for the analysis, design, development, integration, implementation and maintenance of MDOT's statewide Intelligent Transportation Systems. It specifically includes, but is not limited to:

- Task 1 – Update ITS Planning Documents
- Task 2 – Conduct Needs Analysis/Existing Systems Evaluation

- **Task 3 – Develop Concept of Operations**
- Task 4 – Develop Amber Alert Procedures
- Task 5 – Define System Requirements
- Task 6 – Design ATMS
- Task 7 – Design TMC
- Task 8 – ITS Communications Plan
- Task 9 – TMC O&M Programs
- Task 10 – ITS Business Plan

This contract has produced multiple project level documents including infrastructure designs which have been used as references for development of this Concept of Operations.

MDOT ITS Program - Proposed Short Term Staffing Plan and Organizational Structure, March 2007 - This proposed short-term MDOT Intelligent Transportation System (ITS) staffing plan and organizational structure addresses the immediate and short-term (less than 5 years out) needs in organizational structure, skill sets and levels of personnel support for the ITS program.

2.5 Existing System Requirements Documents

No system-wide ITS requirement documents are known to exist at this time, but are included in the scope of the System Integrator Contract as described in section 2.4.

2.6 Concept of Operations Documents

Developing and Using a Concept of Operations in Transportation Management Systems, an FHWA Pooled Fund Study, December 2004 – This document was used as the guiding document for the structure and development of content for this Concept of Operations.

Transportation Management Center Concepts of Operation Implementation Guide, December 1999, USDOT, FHWA-OP-99-029 – This document was used as a guiding document for the development of content for this Concept of Operations.

3. Existing System(s) and Processes

"MDOT is committed to the integration and expansion of its existing ITS systems and infrastructure."

This chapter summarizes MDOT's Intelligent Transportation System (ITS) and processes that are currently in place. These existing components will be modified and updated as needed to facilitate full integration into the future ITS system.

MDOT began its initial efforts to implement an ITS in the late 1990's. The first formal operational vision document, the Mississippi ITS Strategic Plan, was developed in 2001. It was from this Strategic Plan that the MDOT MULTIPLAN was derived. A small MDOT ITS staff has been working over the last several years to install various ITS devices including CCTV cameras, fiber optic and leased-line communications and a traveler information web site (http://www.mstraffic.com/). In addition, a Statewide Transportation Management Center (TMC) has been established in Jackson and three other Regional TMCs are in various stages of planning and development.

MDOT is committed to the integration and expansion of its existing ITS systems and infrastructure. Starting in March 2006, MDOT contracted with the System Integration Team to begin providing general oversight of MDOT's ITS program. This contract provides engineering services including design and standards development for the continued expansion, operation and on-going maintenance of the MDOT ITS program.

The existing components of the MDOT ITS Program which will serve as a starting point for future infrastructure integration and expansion are categorized into the following sections:

- MDOT Organization and Staffing
- MDOT Transportation Management Centers
- Traffic Operations Centers
- ITS Infrastructure
- ITS Services
- ITS Operations

3.1 MDOT Organization and Staffing

As illustrated in Figure 3.1, the Division of Traffic Engineering is responsible for the MDOT ITS program. This division is managed by the State Traffic Engineer, who reports to the MDOT Chief Engineer. Their main responsibilities are freeway operations and field operation of traffic signals on state routes.

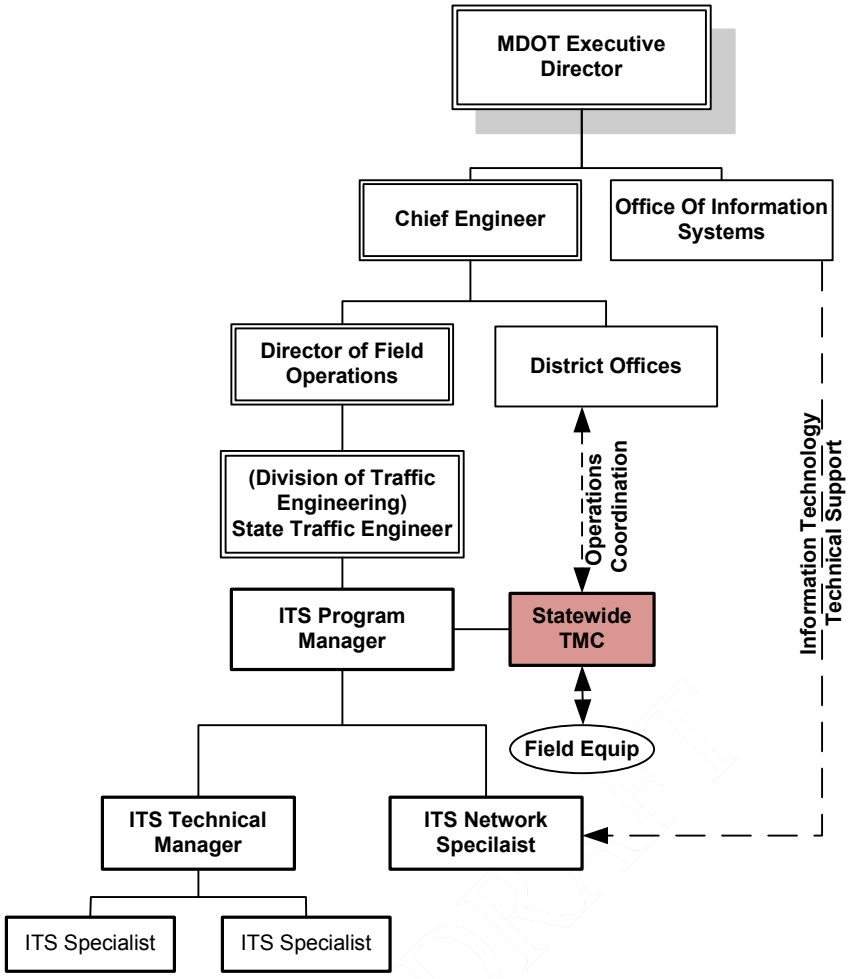


Figure 3.1 – MDOT Organizational Chart

The MDOT ITS Program is managed out of the Division of Traffic Engineering by an MDOT ITS Program Manager, who reports directly to the State Traffic Engineer. He has a staff which manages the daily activities and statewide operations of the MDOT ITS Program. Currently, the ITS program has an ITS Maintenance staff consisting of an ITS Maintenance Manager with two ITS Maintenance Specialists and one ITS Network Specialist.

The ITS Maintenance Manager and two ITS Maintenance Specialists have a responsibility for the existing ITS network and field equipment statewide. The existing MDOT ITS maintenance staff track network performance and provide emergency communications equipment repairs and maintenance. Warranty-level support and maintenance for the Open Transport Network (OTN) is provided by product vendors and maintenance contractors under contract to the Division of Traffic Engineering.

Field equipment, including the communications infrastructure and cameras, are maintained by the maintenance staff with support from the equipment vendors. Repair

parts support is accomplished through the statewide parts contract and by a vendor repair warranty on parts procured through this contract.

Network maintenance and support of the ITS program is managed by an ITS Network Specialist. Although the ITS equipment and network are not part of the MDOT IT network, the ITS section relies upon the Information Systems Division, which reports directly to the Executive Director, for router and network support of the ITS network, as well as software and web support services.

The current staff has a good understanding of the current system, however, the staffing level is not adequate to meet the existing or planned maintenance and operations requirements. A short-term staffing plan has been developed to address the immediate needs and to begin to provide TMC operational staff support for the near future. The *MDOT ITS Program Proposed Short Term Staffing Plan and Organizational Structur*e document, included as Appendix A, addresses the needs for additional maintenance staff and the need for a regional ITS maintenance contract that is inclusive of response times. However, the short-term staffing plan does not address long-term operations and maintenance needs. As the ITS systems expand and TMC operations and services increase, the long-term staffing needs will also have to be addressed.

3.2 MDOT Transportation Management Centers

MDOT has established TMCs in each of the four major urban areas in Mississippi. In these urban areas, MDOT TMC operators will perform freeway and surface street operations on state routes within these urban areas.

Based on MDOT's Concept, there will be TMCs located in the following urban areas: Jackson (Central Region), Biloxi-Gulfport-Pascagoula (Gulf Coast Region), Southaven-Olive Branch-Tunica (Northwest Region) and Hattiesburg-Laurel (Hattiesburg Region). The exact location of the TMC buildings within each urban area has been (or will be) determined based on network considerations, space availability and proximity to key internal and external stakeholders. About 30% of the population of Mississippi, or approximately one-million people, will be served by a Regional TMC. The rest of the state will be serviced by the Statewide TMC in Jackson. Figure 3.2 shows the approximate and proposed geographic locations of these TMCs.

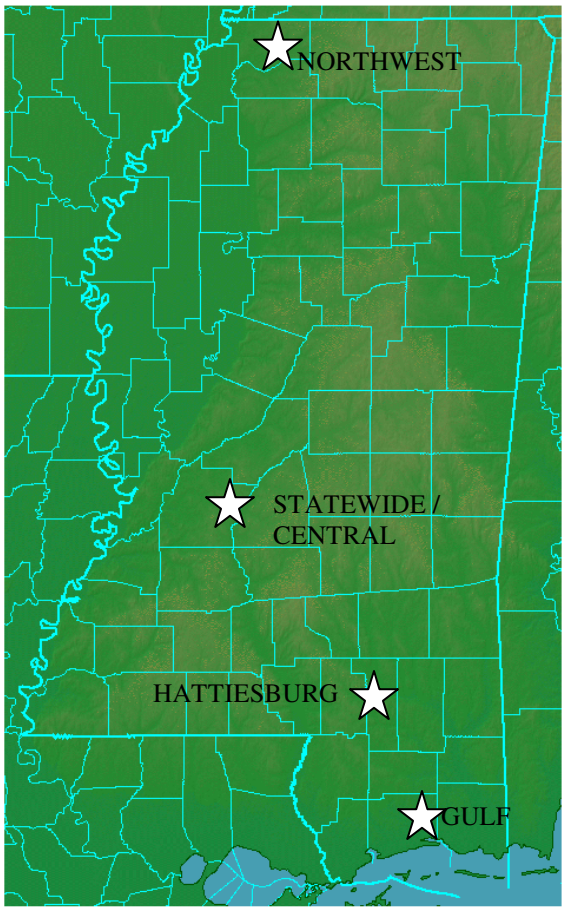


Figure 3.2 – MDOT TMC locations

The current status of the Statewide TMC and each Regional TMC is described below.

MDOT Statewide/Central Region (Jackson) TMC:

STATEWIDE TMC / CENTRAL TMC
Located in Jackson
Base of ITS Statewide Operations
Statewide backup facility
Capable of 24/7 operation
Serves as Regional TMC for Jackson

The existing Statewide TMC is located in MDOT District 5, in the City of Jackson, and is owned and managed by MDOT. This TMC is located at the MDOT Shop Complex

building. The TMC in Jackson will serve both as the Statewide TMC and as the Central Region TMC. The Statewide TMC is currently in place with the equipment described below, but it is currently not staffed and no hours of operation have been established.

The existing facility is configured with a TMC operations control room, an equipment room, a conference room for meetings or management of special events, and an operations room where operators at workstations can monitor CCTV video and road network status as well as web page content.

The Statewide TMC currently has the Chameleon™[2] ITS Suite to control the CCTV cameras, the video wall layout and to select which video streams are displayed in individual windows. It also has the ACTRA™[2] software to control traffic signals and controllers. The equipment room has centralized servers and network equipment for the MSTraffic.com web-site, the Chameleon™ software, the ACTRA™ servers, the web server and the Optical Transport Network (OTN) nodes, including one for fiber ring management.

(TMC Operations Room in Florida)

The Chameleon™ software was updated in June 2007 to include DMS control. However, there is currently no TMC operations staff to use the software or control the devices, however one is currently in the works. There is a short-term staffing plan that is currently being implemented to bring operational staff to the TMC. Training of the initial staff is to be accomplished prior to the completion of the ITS project that will introduce nine DMS devices to the Jackson metro area in the summer of 2008.

MDOT Regional TMCs:

Regional TMCs will have local control of their own field devices and will be responsible for daily freeway and surface street operations. In addition, all Regional TMCs and field devices will also have direct communications to the Statewide TMC in Jackson. The Statewide TMC will serve as a backup to each Regional TMC. It can assume regional access and control operations when the Regional TMCs are not operating or when a situation occurs that necessitates assistance from the Statewide TMC. Exact geographic areas of operational responsibility have not been defined for the Regional TMCs at this time. The staffing plans and operational procedures for each Regional TMC have also not been developed at this time.

[2] Chameleon is a registered trademark of NetManage, Inc.

MDOT Northwest (Southaven Region) TMC:

NORTHWEST TMC
Planned in Southaven
Responsible for Memphis metro area in MS
Coordinate with Tennessee and Arkansas
Co-located with local dispatch center
Mississippi River bridge monitoring
Seeking ATMS to CAD integration

A Northwest Region TMC is planned to be located in Southaven to provide freeway and incident management for the greater Memphis urban area. Development is currently underway for the co-location of this TMC with the existing Southaven Police Department. The Northwest TMC will serve as the primary coordination point for MDOT with the Tennessee DOT TMC located in Memphis. It will also serve as the coordination point with the Arkansas Highway and Transportation Department for sharing of video and data from field devices located at Mississippi River crossings in the northern Mississippi region.

The Southaven police dispatch center was modified in the early summer of 2007 to be a mixed-use facility with TMC operations. Both the layout and the operational procedures will need to be further addressed in order for Southaven to become a fully operational Regional TMC. The Southaven Region TMC/Dispatch Center has an ACTRA™ server for regional traffic signal control. A Chameleon™ server is being configured for regional CCTV camera control; the software will be configured for Southaven to provide main control of their CCTV devices.

MDOT also plans to investigate the integration of the Southaven CAD system to the Chameleon as part of the next-generation of ATMS software. This integration will include the ability for dispatchers to better access MDOT's ITS facilities and also enable transfer of incident status between the two subsystems.

MDOT Hattiesburg (Hattiesburg Region) TMC:

HATTIESBURG TMC
Located in Hattiesburg
Responsible for Hattiesburg area
Co-located with Regional EOC operations
Partnered with local TOC
Hurricane Evacuations and I-59 Contra-Flow

The Hattiesburg Region TMC will be responsible for freeway and surface street operations in and around the City of Hattiesburg, generally south of the Central region

but north of the Gulf Coast region. It will be co-located with the regional EOC, in the new MDOT District 6 headquarters in the City of Hattiesburg. The Hattiesburg TMC will be a strategic partner with the Statewide TMC and the Gulf Coast TMC in managing hurricane evacuations and specifically contra-flow operations on I-59. It will also partner with the Hattiesburg TOC in surface street traffic operations. Figure 3-3 shows the contra-flow routes entering Mississippi on Interstates 55 and 59.

Figure 3.3 – Contra-flow from Louisiana coming into Mississippi

MDOT Gulf Coast Region (Gulfport) TMC:

GULF COAST TMC
Planned in Lyman
Responsible for Gulf Coast area
Incident Management on Interstates 10/110
Hurricane Evacuations

The Gulf Coast Region TMC will be the central data collection location for the Mississippi Gulf Coast and will be responsible for incident management on Interstates 10 and 110 as well as hurricane evacuation of people away from the coastal areas. This TMC, currently in the early planning and development, will be initially located in MDOT District 6 in the City of Lyman (10 miles north of Gulfport) in the MDOT Utility Building at the Lyman Project Office Complex. Future planning efforts are needed to facilitate the implementation of this TMC.

3.3 Coordination with Local Traffic Centers

LOCAL TOC
Managed by Local governments
Focused on Traffic Signals

Gathers real-time traffic conditions
Interfaces to MDOT ITS

Within the State, as shown in Figure 3.4, there are existing and planned Traffic Operation Centers (TOC). These locally operated and maintained centers use ITS field devices to manage traffic and gather real-time traffic conditions and have resources available to make changes to field devices to improve traffic conditions. The majority of TOC operations involve traffic signals on surface streets. MDOT does not have any operational responsibilities for these local centers, beyond data sharing and communications as described later in the document. MDOT does interface directly with the local TOCs and often shares ITS resources where applicable.

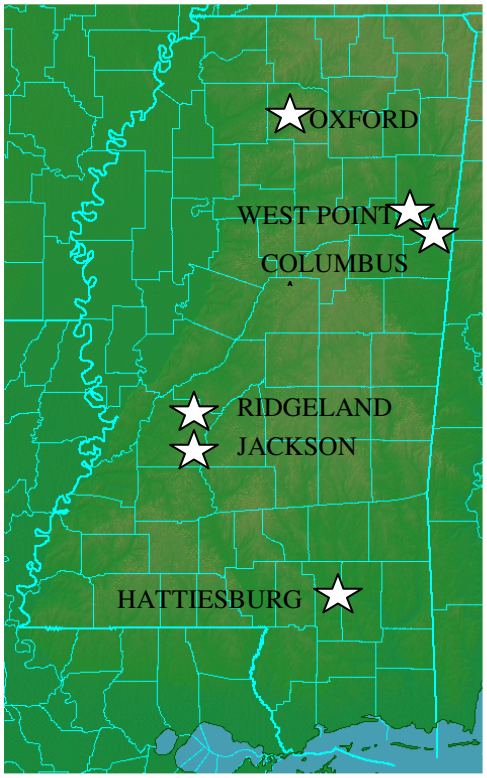


Figure 3.4 – Local TOC Locations (Existing and Planned)

A brief description of the existing local traffic centers throughout the state is provided:

City of Jackson TOC

The City of Jackson currently has a TOC located at 300 North State St. in Jackson. The City of Jackson TOC is currently not manned and specific times of operation are not currently available. The TOC is the central point of communications and coordination for the existing city video cameras and traffic

signals. MDOT and the City of Jackson currently share fiber communications resources and camera views. Once the Jackson TOC and the MDOT TMC are fully operational, it is expected that the two centers will have real-time communications and coordination.

City of Oxford TOC

The City of Oxford's TOC is currently nearing completion and will be co-located in the City of Oxford Police Department. Plans include video display and traffic condition monitoring. MDOT's coordination with the City of Oxford TOC will include sharing of video and real-time communications once both centers are operational.

Other local TOCs:

TOCs are in the planning stages in the City of Ridgeland, City of West Point, the City of Hattiesburg and the City of Columbus. MDOT currently plans to coordinate and communicate with all local TOCs in a manner similar to those described above for Jackson and Oxford.

THE CITY OF RIDGELAND

WEST POINT

CITY OF HATTIESBURG MISSISSIPPI 1884

CITY OF COLUMBUS FOUNDED 1821 MISSISSIPPI

3.4 ITS Infrastructure

MDOT uses various ITS devices to perform its freeway, incident and surface street management responsibilities. These devices include networking, CCTV, dynamic message signs and traffic signals and are managed from each of the MDOT TMCs across the state.

Existing and planned communications capabilities:

The current MDOT ITS network communication scheme has been developed primarily for the transport of video images and communications with traffic signals. Video signals from existing video cameras are transported over MDOT or city-owned fiber, broadband wireless and leased lines to the Statewide TMC in Jackson where they are distributed to the video wall, the MSTraffic.com web site and made available to the broadcast media. Leased lines to Regional TMC provide them service to the MDOT TMC network. Figure 3.5 shows the existing MDOT fiber network schema. Communication over fiber is limited by the existing infrastructure in place. The largest fiber infrastructure, and the one that will serve as the hub for the statewide fiber plan, currently exists in the Jackson metro area where a fiber ring is built along the I-55 and I-220 corridors. These corridors

are connected by fiber along I-20 from I-55 to I-220. The total connection to the TMC is a combination of MDOT owned fiber on the Interstate system and City of Jackson fiber along city streets connecting to the MDOT TMC and the City of Jackson TOC. Figure 3.6 shows the basic fiber infrastructure location within the City of Jackson area. Other fiber segments exist in various locations throughout the state and range from one to five miles in length. Additional fiber segments are currently in the planning and design stages and are typically installed in concert with other roadway or ITS infrastructure projects.

CCTV Cameras and Video control:

MDOT uses CCTV and Video images to monitor freeways and signalized intersections. Operators use these images to detect incidents, verify traffic conditions and assist in making operational decisions. Video control has previously been accomplished manually using a hardware joystick and keyboard. After the Chameleon™ software suite updates and reconfiguration in June 2007, the TMC now has video switching and CCTV control capability using the software-provided GUI. This software is currently configured to control the video switch and the video wall engine. The server for the software, located at the Statewide TMC in Jackson, and all CCTV cameras can be setup, regardless of region, to be controlled from the Statewide TMC. However, to allow regional camera control and account for communication failures, the Regional TMCs such as Southaven will also be equipped with a properly configured Chameleon™ server. Sharing of camera control between the Statewide TMC and the Regional TMCs will be possible by properly configuring the Chameleon™ software suite residing on the Statewide and Regional TMC Chameleon™ servers. Local TOCs will initially have only manual CCTV control with a joystick and keyboard.

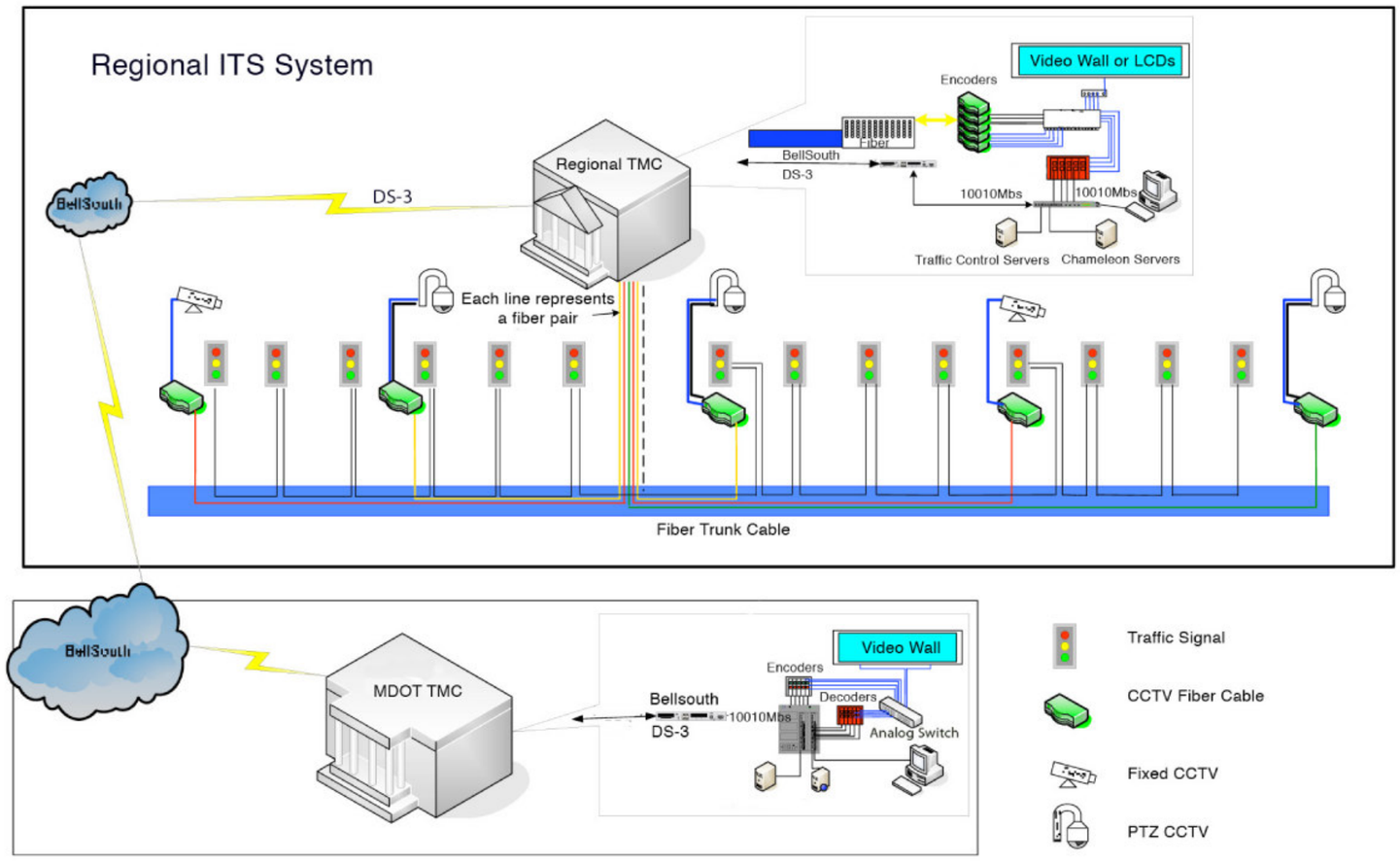


Figure 3.5 – Existing MDOT Fiber Network Schema

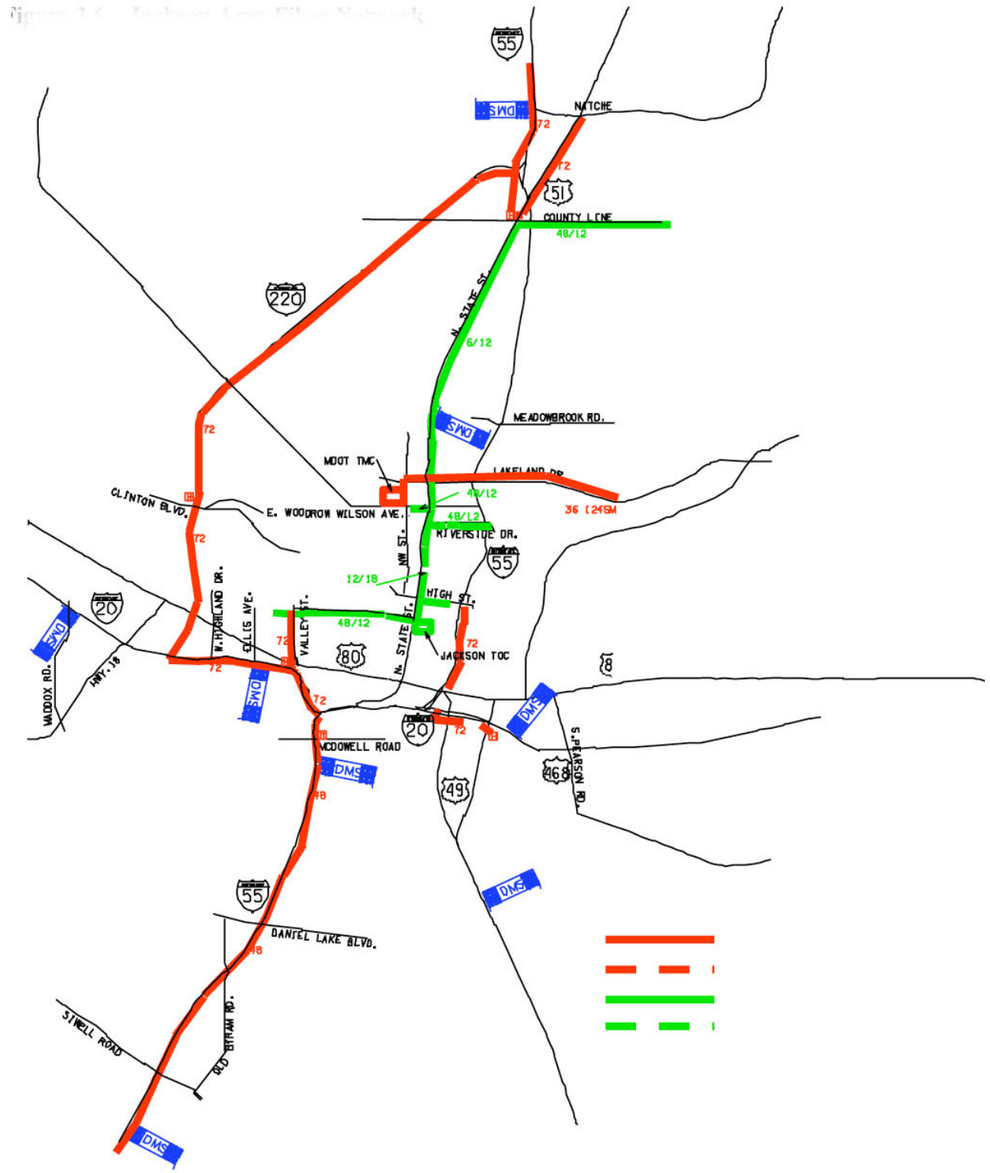


Figure 3.6 – Jackson Area Fiber Network

Dynamic Message Signs:

Dynamic Message Signs (DMS) are used to broadcast important traffic or emergency information to drivers. MDOT does not have any existing permanent DMS devices but has recently issued notice to proceed on a project to install DMS at nine (9) locations in the Jackson area. The placement and utilization of these DMS will be primarily for inbound traffic into Jackson. These DMS devices will be controlled from the Statewide TMC in Jackson. Communications to these signs will be over a combination of fiber and leased line communications.

Traffic Signals:

MDOT operates and maintains traffic signals on the state highway system throughout the State of Mississippi in non-urbanized areas and cities with a population of less than 20,000. Traffic signals in cities of 20,000 or more are operated and maintained by the cities and counties within those urbanized areas. The de-facto standard for traffic signal control is the Eagle controller, which is available on the MDOT statewide traffic signal contract. Many traffic signal controllers operate independently in rural areas with no communications to a central facility, and timing and operations are updated by field site visits. Other signals, whether isolated or in systems, may be linked by various communications methodologies to a central office location or to a Regional TMC where they could be monitored and database modifications could be made and downloaded to the field equipment. The field controllers typically run Eagle EPAC™ [3] software and are monitored centrally utilizing Eagle ACTRA™ central software.

Utilization of Eagle field controllers, controller software and central control and monitoring software by the local governments has become a standard practice. This is because of the availability of equipment and software from the statewide signal contract and availability of vendor support within the state.

Traffic Engineering, not the ITS section, is currently responsible for the maintenance, operation and replacement of the traffic signal systems and for operating traffic signal server software. Maintenance is completed by the MDOT Traffic Signal Shop and through a maintenance and support contract with Temple Engineering. The ITS section does use its fiber and other communication resources to provide a communication link from the central signal server systems (ACTRA™ server) to the field site signal controllers. ACTRA™ is also used to monitor and troubleshoot the communication lines. The ITS Section plans to monitor traffic signal status and alarms through the ACTRA™ interface and will notify signal maintenance and operations personnel when alarms or malfunctions require attention. The ITS section does not foresee developing the skill sets necessary to become responsible for the operational performance, maintenance or development of traffic signal response or timing plans. These responsibilities would remain with the State Signal Engineers. However, a Traffic

[3] EPAC is a registered trademark of Eagle Traffic Control System, Inc.

Controller Systems Administrator, who reports to the TMC/Operations manager, will reside in the Statewide TMC to assist the State Signal Engineers in signal timing tasks.

3.5 ITS Services

MDOT currently provides two types of ITS-related services. One is the MDOT real-time Traveler Information web site and the other is ITS integration of network information that facilitates the dissemination of this information on the web site.

ITS Web Site:

The ITS Web pages are located on a separate ITS Web server linked to the overall MDOT Web server. Although the ITS Web server and Web pages are separate from the primary MDOT Web services, the ITS pages and server are created and maintained by the MDOT Information Services Office. Although the TMC has not yet started operations that would allow the posting of incident information, the www.mstraffic.com web site has up-to-date maintenance and construction content. It also allows individuals to sign up for email to receive construction zone information. The site also provides images from many of the cameras, allowing users to see the latest conditions in real time. The site has a small bandwidth that is well-suited for distributing encoded video over a slow speed connection. The slow speed user can choose to see the "snap shot" from a camera that refreshes regularly, while a high speed user can choose to see streaming video from most of the MDOT cameras. These features make MDOT's traffic Web site one of the more advanced sites operated by any state DOT.

Support for a large number of camera streams requires a robust connection with high bandwidth availability. The internet connection to the ITS web server and the entire MSTraffic.com network is a separate DS-3 connection from the MDOT primary internet connection and is reserved exclusively for ITS applications.

Figure 3.7 shows the opening screen from the MDOT ITS website (http://www.mstraffic.com/).

Figure 3.7 – MDOT ITS Home Page – (http://www.mstraffic.com/)

ITS Integration:

At the time of development of this Concept, the MSTraffic network transmits both video and traffic signal data from the existing City of Jackson ITS. Some integration with the Chameleon™ software for CCTV and video switch control will be available at the Statewide TMC. DMS control will be included in this software package once they have been installed. Some level of integration for sharing video and camera control between Regional TMCs and the Statewide TMC will be developed.

3.6 ITS Operations

As mentioned previously, there are no current real-time operations (or operations staff) associated with the existing ITS elements described in this chapter. A short-term staffing plan is being implemented to provide additional staff through hires of MDOT personnel and staffing and maintenance contracts. This short-term plan would provide for new staff members consisting of one State ITS Engineer, one ITS Network Specialist, one ITS Technical Manager, one 511 Coordinator (once 511 is funded and in the implementation stage) and one Operations/TMC Manager. Additional TMC Operator support is recommended utilizing contracted employees. The plan recommends that the State ITS Engineer, the ITS Network Specialist, the ITS Technical Manager and the

Operations/TMC Manager be hired as MDOT employees, while the remaining positions will be filled by either MDOT employees or contract staff answering directly to the State ITS Engineer. IT support would continue to be provided by the MDOT Information Systems Section. The short-term staffing plan recommendations and proposed staff organization can be reviewed in the *MDOT ITS Program, Proposed Short Term Staffing Plan and Organizational Structure*, dated March 2007.

The current Short Term Staffing Plan does not address staffing at the Regional TMCs. It is anticipated, however, that each Regional TMC would have some TMC Operator staffing. Whether this staff would be new hires, existing staff or contract employees is outside the scope of this document. This staffing will need to be addressed prior to those facilities becoming operational. Operational procedures will also need to be developed for center to center coordination and for operations within each respective TMC and TOC.

4. Proposed System Concept

"User Service Bundles and Market Packages identified in the Statewide Architecture were reviewed and those user services and market packages directly applicable to this MDOT concept were customized for inclusion in this Concept of Operations."

The proposed System Concept takes advantage of the existing Jackson metro ITS system and integrates it into a new robust statewide ITS deployment. This chapter describes the Concept for this proposed Statewide ITS system and specifically covers the following topics:

- Background, Objectives and Scope
- System Description
- TMC Operations
- Users and Stakeholders
- Proposed MDOT Organizational Structure
- ITS Steering Committee
- ITS Operations Policies and Constraints
- Support and Maintenance

4.1 Background, Objectives and Scope

The objective of this Concept of Operations is to meet the overarching goals and objectives that were developed by consensus process, set forth in the original Mississippi ITS Strategic Plan and later adopted by the Statewide ITS Architecture. These goals and objectives were identified in Chapter 1 of this document. This Concept document is the ITS concept for MDOT and is not intended to be all inclusive of ITS deployment needs or system concepts for state and local agencies other than MDOT. For the purposes of the development of this Concept of Operations, a scope covering a ten (10) year horizon was assumed. This concept, which is fiscally unrestrained in scope, is representative of potential ITS development by MDOT during that time horizon.

Figure 4.1 is the Systems Engineering process that is being used by MDOT throughout the ITS lifecycle. The Concept of Operations is the third step in the process as shown. The completion of the Statewide ITS Architecture in April 2007 and the Needs Analysis associated with developing this document are the completed steps in the Systems Engineering process.

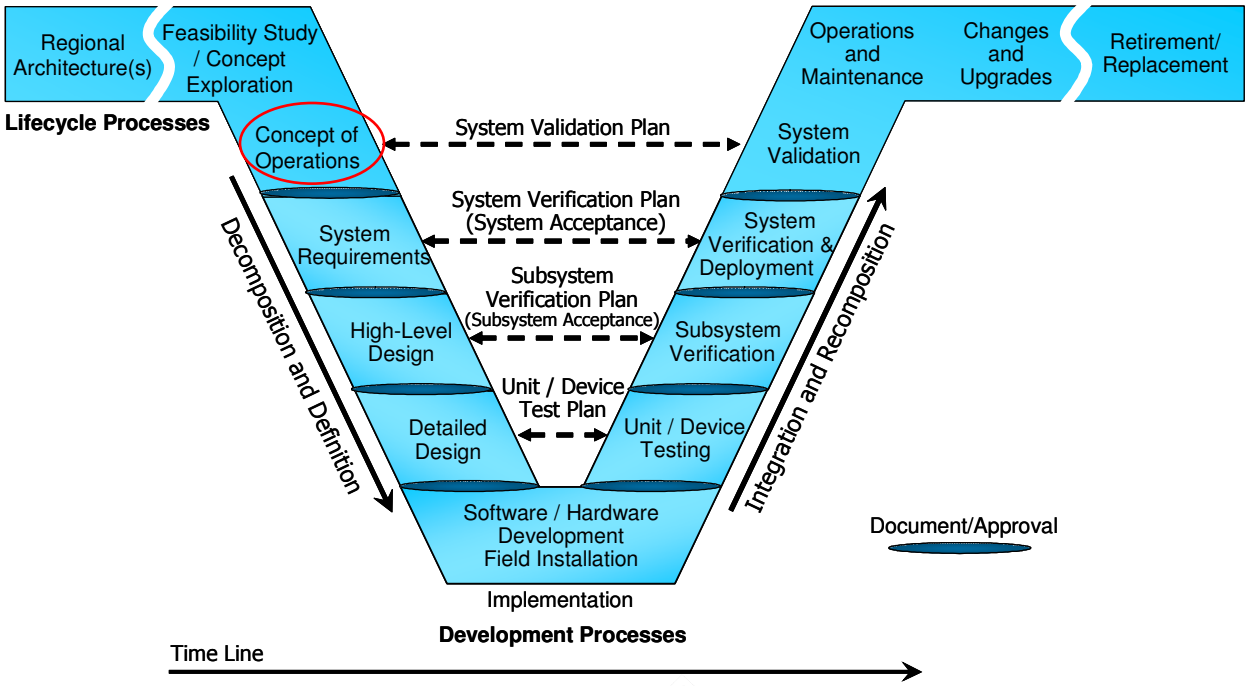


Figure 4.1 – Systems Engineering Diagram

4.2 System Description

The initial efforts of creating a statewide concept for the MDOT ITS system utilized the National ITS Architecture as the basis for the development of the Statewide ITS architecture for MDOT and the State of Mississippi. The User Service Bundles and Market Packages identified in the Statewide Architecture were reviewed and those user services and Market Packages directly applicable to this MDOT concept were customized for inclusion in this Concept of Operations. Table 4.1 lists the Market Packages that are applicable to MDOT in this Concept, which represents the application of the Statewide ITS architecture at a system level. The Concept implements multiple services from the five categories shown in the left column of Table 4.1.

Individual descriptions and diagrams of the Market Packages, tailored to meet MDOT needs, can be found in Chapter 6 of this document. These descriptions and packages are customized from the National ITS Architecture Market Packages and include the identification of basic equipment packages.

Table 4.1 – Applicable MDOT Market Packages

Category	Market Package	Market Package Name
Archived Data Management (AD)	AD1	ITS Data Mart
Advanced Traveler Information Systems (ATIS)	ATIS02	Interactive Traveler Information
Advanced Traffic Management Systems (ATMS)	ATMS01	Network Surveillance
	ATMS03	Surface Street Control
	ATMS04	Freeway Control
	ATMS06	Traffic Information Dissemination
	ATMS07	Regional Traffic Control
	ATMS08	Traffic Incident Management System
	ATMS13	Standard Railroad Grade Crossing
	ATMS19	Speed Monitoring
	ATMS21	Roadway Closure Management
Emergency Management (EM)	EM04	Roadway Service Patrols
	EM06	Wide-Area Alert
	EM07	Early Warning System
	EM08	Disaster Response and Recovery
	EM09	Evacuation and Reentry Management
	EM10	Disaster Traveler Information
Maintenance & Construction Management (MC)	MC04	Weather Information Processing and Distribution
	MC07	Roadway Maintenance and Construction
	MC08	Work Zone Management
	MC10	Maintenance and Construction Activity Coordination

The MDOT ITS includes much more than the integration of software and information technology hardware to control and manage the ITS system and provide coordination and decision support for its users. The complete system includes the following:

- Transportation management centers
- Field control equipment
- Communications infrastructure
- Operational policies and procedures
- User and owner agreements

The system also includes many other components working in conjunction with integrated software and hardware packages to provide the overall functionality and operations outlined in this concept. References in this concept to the MDOT ITS include the overall ITS system as well as any integrated software applications.

The MDOT ITS software will be utilized throughout MDOT for basic ITS operations. The software will provide the basis for the coordination of ITS operations throughout

MDOT and with other agencies and partners utilizing the MDOT ITS. The MDOT ITS software will also be available to other state and local agencies for their use in management and control of their transportation related assets. Where the system is utilized by other authorities such as cities, counties or transit properties the local authority will have the ability to define user privileges within their authority. Privileges for access to information between local or other system users and MDOT will be controlled by MDOT.

4.3 TMC Operations

MDOT will operate the ITS from a Statewide TMC located in Jackson as well as individual Regional TMCs located throughout the State. The MDOT ITS staff will be responsible for the development of statewide policies and procedures governing the operations of all MDOT TMCs and will work with Regional TMC operations personnel, MDOT District personnel, local agency personnel and other state agency personnel to assist in the development of localized policy and procedures for each Regional TMC.

Figure 4.2 is a limited depiction of the operational relationships associated with the total MDOT ITS system. Not all potential partners or users are shown. ITS user classes and their associated privileges are discussed in Chapter 5.

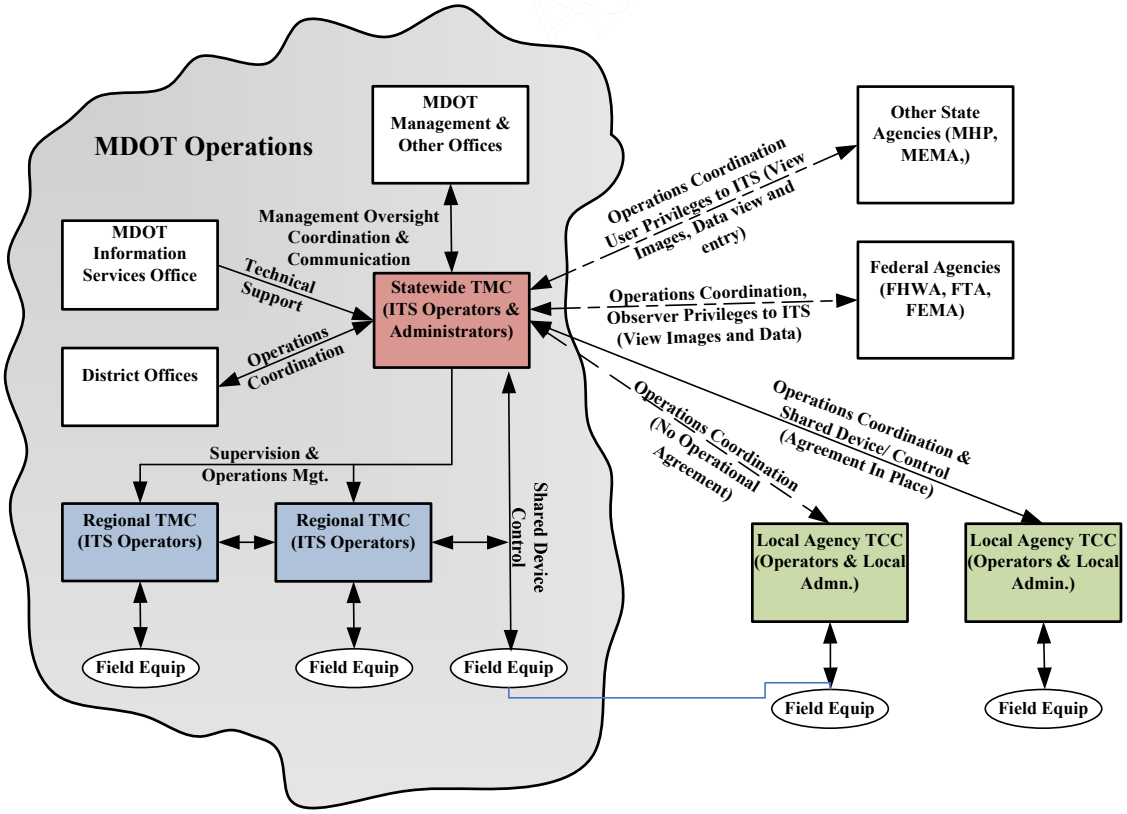


Figure 4.2 – Mississippi ITS Operational Relationships

Regional TMCs:

Each Regional TMC will be responsible for monitoring and control of ITS field equipment within its geographic area of responsibility. They will be responsible for normal region operations including response plan operations, maintenance trouble ticket management, regional MDOT resource dispatching and maintenance and updating of system database information related to their regional contacts. During their normal operations they will receive calls related to transportation operations within their area of responsibility and will enter incident and other transportation related data into the ITS incident management sub-system, once one is in place.

Regional TMCs will also be responsible for coordination of all transportation related items, within their geographic area of responsibility, with other users and agencies and MDOT as necessary. Hours of operation of individual TMCs will vary based upon needs and available resources. The exact geographic boundaries of operational responsibility for each Regional TMC must be identified to allow for the development of operational procedures for each TMC and to provide for the development of database information related to incident response plans, event plans, contacts and other necessary information that will be geographically dependent. The geographic boundaries will not necessarily conform to the existing boundaries of the MDOT Districts, therefore, coordination of one TMC with multiple MDOT District Offices and resources may be necessary.

Regional TMC response plans, contact databases, field equipment databases and configurations and other operator level system configuration and administrative functions will be accomplished by the Regional TMC staff. This will be managed under direct supervision of the MDOT Operations/TMC Manager with assistance from other MDOT ITS staff as necessary.

Statewide TMC:

The MDOT Statewide TMC in Jackson will have several responsibilities. Some of these responsibilities relate to its role as the Statewide TMC. Others relate to its role as the Central Region TMC.

<u>Statewide responsibilities:</u>

The Statewide TMC will be responsible for day-to-day operational backup and support of the other three MDOT Regional TMCs. It will assume complete operational control for these and the devices they control during times when they are not normally operational or when other circumstances render them inoperable.

The Statewide TMC will provide system-wide backup capabilities for all system configuration information including the following:

- Operational databases
- Configuration files
- System log files

- Network configuration documentation and databases
- ITS IT software and hardware configuration information

MDOT ITS staff located at the Statewide TMC will be responsible for all system hardware and software installation, upgrades, configuration, user administration as well as system and software restoration in the event of a system failure.

The Statewide TMC will be responsible for the development and configuration of all statewide incident and event response plans as well as ones that involve multiple Regional TMCs. These plans will be developed so that they may either be executed statewide, in multiple regions or in only one region.

The Statewide TMC will be responsible for receiving all AMBER Alerts and for coordinating the posting of all AMBER Alert messages by all the MDOT Regional TMCs.

Regional responsibilities:

The Statewide TMC will be responsible for direct monitoring and control of ITS field equipment within the Central Mississippi Region and will perform all the functions of a Regional TMC. These responsibilities include those items described earlier in this section:

- Execute response plans
- Manage maintenance trouble ticket submission
- Dispatch regional MDOT resources
- Maintenance and updating of regional contact information.
- Receive calls related to transportation operations
- Enter incident and other transportation related data into the ITS incident management sub-system
- Coordinate all regional transportation items with other users and agencies and MDOT
- Determine hours of operation based upon needs and available resources

TMC Agreements:

The MDOT ITS will be granted the ability to monitor and operate local agency field equipment connected to local TOCs and for the capability for specified system operations based upon revenue sharing between the local agency and MDOT. The following, as shown in Table 4.2, are examples of the capabilities that could be included in such agreements:

Table 4.2 – MDOT Agreements with Other Entities

MDOT Agreement Party	Type of Agreement	Benefit
Emergency Broadcast System (EBS)	The ability to re-broadcast AMBER Alerts sent out by the EBS.	MDOT is able to serve the general public using all available ITS information resources.
Local Agencies	The ability for monitoring and posting of messages on DMS owned by local agencies.	MDOT retains the ability to broadcast important messages even when the local agency TOC is not manned or when a pre-approved message is called for by a system-wide response plan.
	The ability to monitor and control PTZ cameras owned by local agencies. The ability to post images from PTZ cameras to the MDOT video walls and the web site.	MDOT can use these images to manage traffic and incidents and motorists can view these images and make informed driving decisions.
	The ability for MDOT to activate a pre-approved signal timing plan for incidents.	Traffic patterns can be returned to normal quicker following incidents if these types of decisions can be made interactively and remotely by MDOT.
	The ability for MDOT to monitor and operate other ITS field devices that may be deployed by local agencies such as HAR and other electronic traffic signs.	MDOT retains the ability to broadcast important messages or perform other necessary device control operations even when the local agency TOC is not manned.
Various	The ability for MDOT operators to approve and modify voice and email messages for locally identified contacts based upon pre-approved response plan messages.	Improves the flow of critical information during emergencies or significant incidents or events without having to wait for approval.

MDOT will not have the ability to modify local databases, response plans, contact listings or field equipment configurations, nor will it assume any operational responsibility for locally owned and operated traffic signals.

MDOT will allow other state and federal agencies and offices access to the MDOT ITS with privileges ranging from those of an Observer to limited Operator capabilities. Privileges will be determined by revenue sharing between MDOT and the individual state and federal agencies and their use of the system for management decision support of their transportation missions.

4.4 Users and Stakeholders

During the Statewide Architecture process, users and stakeholders and their ITS roles were identified, as shown in Table 4.3, along with a brief description of their role in

Table 4.3 – MDOT Stakeholders and Roles

Stakeholder Name	Description/Role
Federal Highway Administration (FHWA)	Project approval, funding approval, project oversight.
National Weather Service	Provide weather forecast and warnings related to adverse weather conditions that are used by the ITS as input information.
Mississippi Department of Transportation (MDOT)	Project planning, project design, project funding approval and management, project construction management, ITS operations and maintenance, emergency management coordination, roadway construction and maintenance management and information technology management and support. Service Patrol operations and management. MDOT is the primary owner and operator of the ITS system.
Mississippi Department of Public Safety	Provide support for incident management initiatives and management support for coordination of resources in incident and emergency management planning and response activities.
Mississippi Emergency Management Agency (MEMA)	Prepares, coordinates and supports statewide emergency management activities for major emergencies and disasters.
Mississippi Highway Patrol (MHP)	Patrols state roadways, including interstates, state highways and secondary county roads, enforces motor vehicle laws and assists in major incidents and emergencies. Shares information with MDOT ITS and coordinates Standard Operating Procedures (SOP) with MDOT Service Patrols to improve utilization of resources during incidents and other events.
Mississippi Bureau of Investigation	A bureau of the Mississippi Department of Public Safety that issues AMBER Alerts.
Neighboring States	Adjacent states that coordinate with Mississippi DOT on transportation management within state border regions. Neighboring states include Tennessee, Alabama, Louisiana and Arkansas.
Metropolitan Planning Organizations (MPO)	Three MPOs, including Gulf Coast Regional Planning Commission, Forrest-Lamar-Hattiesburg-Petal MPO and Central Mississippi Planning and Development District, that provide transportation planning and technical assistance services to various agencies within the MPO jurisdiction areas. Assist in project programming and coordination and users of future transportation data gathered and archived by the MDOT ITS.

Stakeholder Name	Description/Role
Counties and Cities	The counties, cities, municipalities and universities that have ITS components and enter into agreements with MDOT to participate in the ITS by using the MDOT ITS or by allowing access and/or control of ITS devices by the MDOT ITS.
County and City 911 Dispatch Centers	Dispatch centers that receive 911 emergency calls and dispatch sheriff, police, fire and EMS within the jurisdiction areas. Dispatch centers may utilize the MDOT ITS for decision support and to monitor transportation activities within their geographic area of responsibility. Points of contact for MDOT ITS Operators performing incident management and emergency response activities.
County Engineering and City Public Works	County engineering offices/city public works departments responsible for traffic control and management and county/city roadway and bridge maintenance and construction within their jurisdictional areas. Offices or departments within public municipalities responsible for control and maintenance of ITS devices as well as input of activities data (maintenance and construction restrictions) to the ITS.
County and City Public Safety Agencies	County sheriff's offices, city police and university police departments, city fire departments and county/city emergency medical services, which are responsible for public safety and incident/emergency response within the jurisdiction areas.
Transit Agencies	Transit agencies providing transit services throughout Mississippi that utilize the MDOT ITS and participate in the MDOT ITS by agreement. Includes those agencies that maintain web sites which are linked from the MSTRAFFIC. COM web site.
Airports	Airports owning regional airport information systems, including Jackson-Evers International Airport and Gulfport-Biloxi International Airport and who, by agreement, utilize the MDOT ITS for observing surface traffic conditions.
Local Traffic Generators	Traffic generators/event promoters that have knowledge of events that may impact travel on roadways or other modal means and share information with MDOT and emergency service providers.
Railroad Companies	Owner/operators of rail transportation facilities that interface with the MDOT ITS through railroad crossing pre-emption connectivity with traffic control signals or where the railroad provides other detection outputs that can be used by the ITS to activate response plans or field device programs.
Private Towing and Wrecker Services	Provide response and clearance capabilities for roadway incidents.
Media Outlets	TV and radio stations, news media, etc.

MDOT ITS operations. Generally, stakeholders are either focused on just one area or topic, such as state or multi-state level agencies, or they represent organizations providing similar functional roles, usually at the regional or county/city levels.

4.5 Proposed MDOT Organizational Structure

Primary operations management of the MDOT ITS will be provided by the Mississippi Department of Transportation in a work group called the ITS Section, which is under the direct supervision of the State Traffic Engineer. The State ITS Manager will be in charge of daily ITS operations at the Statewide TMC and will coordinate the MDOT ITS program on a statewide basis out of the ITS Section.

Operations management of the other Regional TMCs located throughout the state will be the responsibility of the Statewide TMC Operations Manager, who is part of the ITS Section staff, with operators located in the Regional TMCs being under his or her direct supervision. The Statewide TMC Operations Manager will be responsible for coordination of operations with the MDOT Districts in the development of SOPs for defined geographic areas of responsibility and for input and concurrence in the development and execution of response plans.

MDOT will also have a Traffic Controller Systems Administrator employed at the Statewide TMC who will be responsible for developing signal timing plans to be implemented from the TMCs. This individual would develop timing plans for freeway diversions due to incidents and other events such as evacuations, etc. Also, he or she would develop timing plans for implementation on surface facilities affected by evacuations, major incidents, special events, etc. This person would work for the Statewide ITS Manager but would coordinate with the District signal personnel regarding the signal plans and criteria for implementation of all developed plans. He or she would serve as the primary coordination person between MDOT and the District Traffic Engineering personnel responsible for signal timing and operations. This person would also provide coordination across District boundaries for signal operations where a TMC has responsibility in more than one District's geographic area. They would also act as a liaison, in coordination with their District counterparts, with the local governments where local governments have responsibility for signal timing and operations, such as in Jackson.

The MDOT ITS Section will be responsible for the maintenance of ITS field equipment and communications infrastructure, as well as for information technology support for all MDOT owned computing, communications and networking equipment utilized by the ITS, as well as system administration. The Office of Information Systems will provide technical support to the ITS Section as necessary. The ITS Section will maintain system-wide configuration management of the total ITS information technology environment.

Figure 4.3 depicts the basic MDOT management organizational structure for the MDOT ITS.

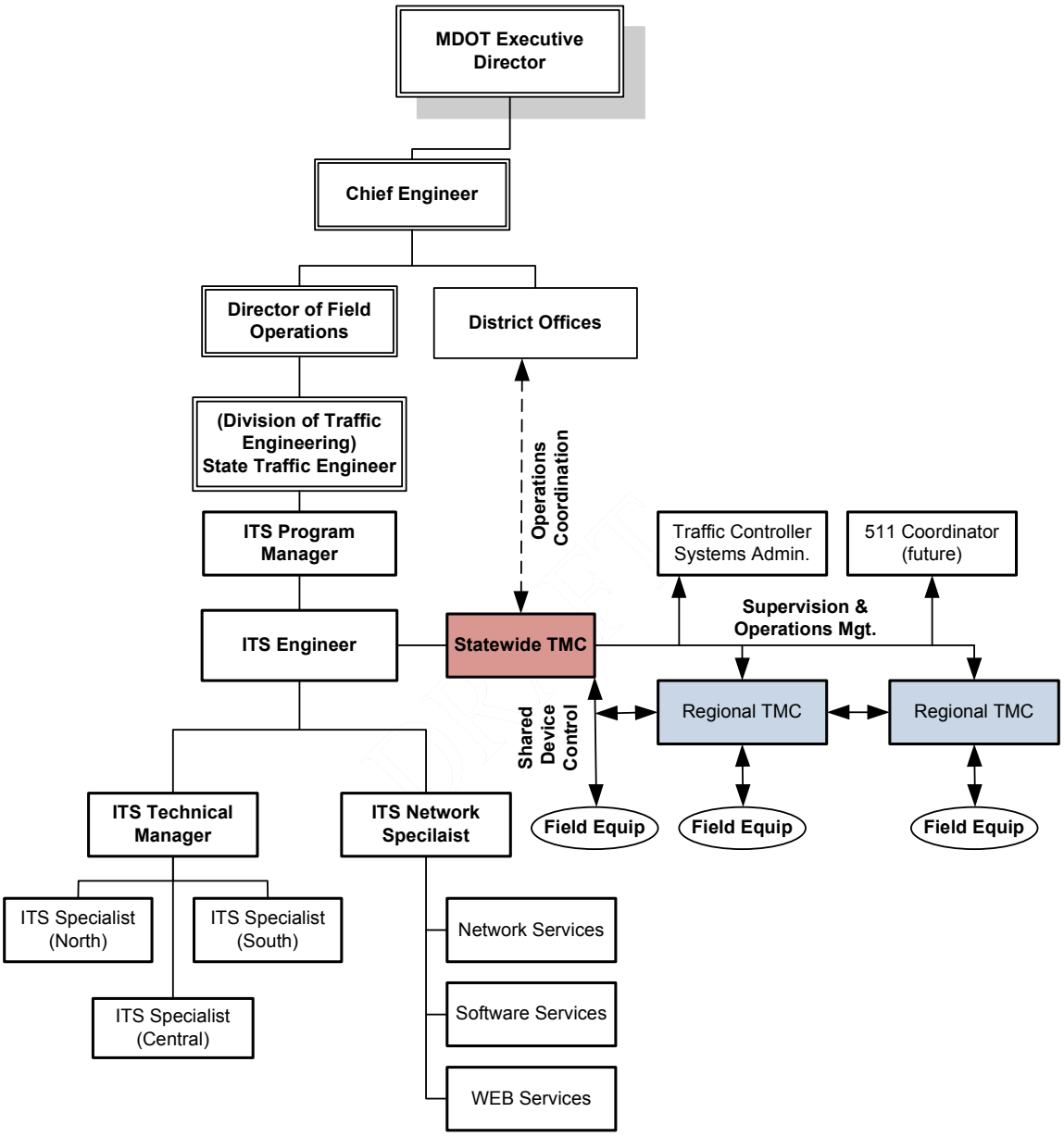


Figure 4.3 – Proposed MDOT ITS Organizational Structure

4.6 ITS Steering Committee

Because the MDOT ITS is intended to be the ITS cornerstone for the entire State of Mississippi, other agencies, municipalities and universities will access the MDOT ITS by agreement with MDOT. To facilitate operational coordination, system management,

future system improvements and system-wide maintenance needs, an ITS Steering Committee representing the broader system user community will be established. This steering committee will work to disseminate information to all system users related to system upgrades, standards, configuration modifications, maintenance issues and any other issues impacting the system user community. The steering committee will also serve to develop future needs documentation, review proposed system modification concepts and plans and assist in the development and maintenance of standard operations procedures and agreements affecting the total MDOT ITS user/operator community. MDOT will provide the Chairman for the steering committee with other users providing the remaining standing committee members. Technical support may be drawn from member organization resources as needed to facilitate the work of the committee.

As defined in Chapter 12 of the Statewide ITS Architecture, the Statewide ITS Steering Committee will consist of the following agency representatives:

- MDOT State Traffic Engineer
- MDOT Planning Engineer
- MDOT ITS Program Manager
- Central Mississippi Planning & Development District Director
- Gulf Coast Planning Commission Director
- Northwest Mississippi (DeSoto County) Representative
- Mississippi Department of Public Safety (Highway Patrol)
- City of Jackson

4.7 ITS Operations Policies and Constraints

There are four areas in which ITS operations policies and constraints need to be considered:

- Facility ownership
- Software Licensing
- Staffing
- Budgeting

Facility Ownership:

MDOT is responsible for operations and maintenance of the State Highway System within Mississippi. When considering MDOT agreements with other parties concerning the sharing of responsibility for ITS facility operations, there are two relationships to be considered:

Local agency-owned facilities

Operations and maintenance of ITS facilities off of the State Highway System are the responsibility of the local government. Sharing of material and human resources for

maintenance of portions of the ITS, which may exist upon or connect across both state and local facilities, will require review and possible changes to existing DOT and local policies. Sharing of operations for facilities, owned by either MDOT or local governments, will require agreements for access to the facilities for those parties who are not employees of the owners of the facilities.

Other independent government authority facilities

Sharing of the operation and control of field equipment located on facilities owned and operated by independent governing authorities will require development of operational policies and agreements specifying the circumstances for sharing of operational control and any limitations which will be imposed.

Software Licensing:

The core MDOT ITS will be an integrated software, database, and network management system utilized to control field devices and to provide decision support and management of transportation related events. The development of such a system involves the utilization of software packages under license from various vendors and suppliers and potentially software developed by MDOT. Operational policies related to the support, sharing and licensing of these types of products will require review and possible modification or development to accommodate system deployment.

Staffing:

The deployment and operations of the MDOT ITS will be constrained by the ability of MDOT and its partner agencies and users to create new staff, in adequate numbers and with the skill sets required, to develop, operate and maintain the total system. It is assumed that agency resources will be supplemented by contract personnel and that supervisory responsibility will remain with MDOT staff and local agency managers.

Budgeting:

Budgetary considerations will also be a constraint to the entire system due to the necessity to fund long-term operations support contracts and to insure that adequate funding is available to construct the system and to perform required maintenance of installed ITS infrastructure.

4.8 Support and Maintenance

The MDOT ITS is maintained by a combination of MDOT staff, contract staff and network service providers.

MDOT personnel and contract resources work together to maintain traffic signals, cameras and other traffic control devices located on the Mississippi State Highway System. Additionally, MDOT maintains a local communications infrastructure along

major highways in the Jackson metro area, including department-owned copper interconnect cables, fiber optic cables and wireless (microwave) systems.

Center-to-Center (C2C) communications, between TMCs and with TOCs, is currently a combination of leased communications capacity and MDOT Department-owned infrastructure. MDOT, along with contract resources, will maintain the field equipment and communications infrastructure it owns along state highway right-of-ways, but utilize the service providers to maintain the leased lines. .

With the expansion of the ITS infrastructure and the continued growth in the numbers of traffic signals throughout the state, it will be necessary to dedicate additional financial and human resources to maintenance of the ITS field equipment and supporting systems. To meet these increased demands and maintain acceptable service levels for the overall system, MDOT should expand its contract resources for maintenance of both field equipment and systems operations support. Additionally, MDOT should investigate the possibility of extended warranty repairs as part of the procurement process for field devices and support system hardware.

Other Maintenance and Support Considerations:

- MDOT will award contracts for field equipment support by geographic area based upon response requirements and the number of cameras, dynamic messages signs, communications infrastructure and other ITS devices within the defined areas.

- MDOT will continue to maintain a core group of Department personnel capable of responding to maintenance calls. These personnel will respond 24x7 to emergency situations and will monitor, schedule and inspect contractor maintenance activities.

- MDOT will maintain and/or contract for services to provide all C2C communications for centers where MDOT is the owner or shares the facility with local authorities and the center is connected to the overall MDOT ITS.

- MDOT will expand its statewide contract for procuring traffic signal equipment, communications equipment and related items. This contract will continue to be available to local governments for their use in procuring this type of equipment. The contract expansion will include additional equipment and materials used in the MDOT ITS, allowing for the procurement of items meeting the MDOT ITS specifications by all users of the system.

- MDOT will contract for operations support to provide maintenance and system operations and support personnel. These contracts will provide support on a task order basis. Contract personnel will be used in TMCs owned and operated by the Department and may be used where MDOT shares facilities with other agencies or local authorities. Supported areas may include, but will not be limited to, system operators, service patrol operators and dispatchers, software and system administrative support, network administration, engineering support and maintenance and configuration management.

- Local agencies or municipalities who utilize the MDOT ITS base system will be responsible for the maintenance of the information technology and communications equipment they own and operate.

- MDOT will provide software support for the core software, which is developed by MDOT for the system and/or licensed for use within the overall system.

- User agencies or local governments will be responsible for obtaining independent licenses required. These include Commercial Off-The-Shelf (COTS) products needed to operate the system, such as database license, operating system license, network and firewall management licenses, etc. Where MDOT shares a TMC or TOC with one or more agencies or local authorities, the costs of IT equipment, communications and software license for system operations will be shared between the parties.

5. User System Relationships and Privileges

"Users of the MDOT ITS will vary widely in their needs for access to the ITS system and its various services, functions and components."

Determination of user access privileges will be based upon the need for and the use of specific types of information, system operational responsibilities, level of knowledge, skill sets, system security considerations and system access methodology. Different user classes will be assigned different privileges to operate and interface with the system based upon these requirements and considerations. System access privileges will range from system administration and the ability to configure software, information technology hardware, databases, add other users and assign user privileges to view only access for certain internal and external users such as the media. Some of the positions described will be required only at the Statewide TMC and others will also be needed at the Regional TMCs. However, exact delineation of who is needed and where they might be placed is beyond the scope of this Concept.

5.1 ITS User Classes

For the development of this Concept of Operations the user classes have been broken down into thirteen (13) distinct user classes or groups, which are defined in Section 5.1.1 through 5.1.13.

Table 5.1 shows the anticipated assignment of privileges of the thirteen (13) user classes of the MDOT system. Descriptions of each user class and their relationship to the overall system follow the table. The user classes shown in Table 5.1 are not specific positions or titles within MDOT but are representative of user classes which will exist for an operational system as conceived by MDOT.

5.1.1 ITS Information Technology Manager

The ITS Information Technology Manager class will have the same capabilities as the System Administrator class but will be able to add, modify and remove System Administrators.

5.1.2 ITS System Administrator

The ITS System Administrator class will have access to all system functionality except that reserved for the ITS Information Technology Manager. A System Administrator user will be able to configure the software, manage users, monitor system performance and perform various other system administrative functions.

Table 5.1 – Anticipated User Class Privileges

System Privileges	ITS Info. Tech. Mgr.	ITS System Administrator	ITS Engineer	ITS Operator	Service Patrol Dispatcher	Service Patrol Operator	ITS Operator Trainee ***	ITS Maintenance Staff	Const. & Maintenance	Internal Web User	Archive Data User	Media User	Observer
System Admin. + Add Administrators	◘												
Software, Database, Network, & Hardware Admin. + Add Users	◘	◘											
System Operations Parameters			◘	*◘									
ITS Equipment Configuration			◘	*◘				◘					
ITS Equipment Operations			◘	◘	**◘		◘	◘					
Incident Management			◘	◘	◘	◘	◘						
Response Plans			◘	◘	◘		◘						
Service Patrol Dispatch & Data Entry			◘	◘	◘	◘	◘						
Road and Lane Closure Data Entry & Revision			◘	◘	◘		◘	◘	◘				
Camera Control			◘	◘	◘		◘	◘					◘
Video Wall Control			◘	◘	◘		◘						
System Reports			◘	◘	◘	◘	◘						
Notification Functions			◘	◘	◘		◘		◘	◘			
Field Equip. Status, Maint. Status Reports			◘	◘			◘	◘					
Video (View Only)										◘		◘	
System Status (View Only)								◘	◘	◘		◘	◘
Archive Data Access			◘	◘			◘				◘		

* Privileges are under supervision of ITS Engineer.

** May be assigned if performing as Dispatcher and Operator

*** Privileges are under direct supervision of Operator or ITS Engineer at all times.

5.1.3 ITS Engineer

The ITS Engineer class will have access to all system functions necessary to configure system response plans, enter and modify field equipment parameters and databases, create, edit and modify system reports and assign geographic areas of responsibility to other Operators. ITS Engineers will have the capability to override system response plans and implement independent plans by ITS field equipment including DMS, ramp meters, traffic control signals and HAR units. The ITS Engineer class will have access to all system functionality available to all other user classes except that reserved for ITS System Administrator and ITS Information Technology Manager. Additionally, the ITS Engineer have some responsibility for reports of performance, daily/weekly/monthly reports of operational status.

5.1.4 ITS Operator

The primary responsibility of the MDOT ITS Operator will be the monitoring of the surface transportation system for incidents and the proper operation of ITS field equipment. ITS Operators will detect and verify incidents and will build and execute response plans to manage the incident. ITS Operators will monitor on-going incidents and modify response plans as needed to improve incident management or to accommodate other events that may occur while an incident is on-going. ITS Operators will receive phone calls from travelers and will provide information related to roadway system performance and incident locations. They will also receive information from travelers related to incidents and other roadway performance and enter this information into the ITS. ITS Operators will assist in the maintenance of the response plan database and will maintain up-to-date contact information for internal MDOT resources as well as external personnel and resources. ITS Operators will dispatch MDOT resources for incident response and may dispatch Maintenance resources for normal maintenance operations in assigned geographic areas or as backup for other areas where the TMC is not operational. They will report information on malfunctioning ITS field equipment to the Maintenance staff as needed.

5.1.5 Service Patrol Dispatcher

The Service Patrol Dispatcher will be primarily responsible for monitoring and dispatch of MDOT service patrol resources. In this capacity the Service Patrol Dispatcher will have access to the service patrol computer aided dispatch functions of the ITS, incident management functions, response plans, roadway and lane closure functions, video systems control and notification functionality. The Service Patrol Dispatcher may be granted access to the ITS equipment operations functions when they are assigned dual responsibilities of Service Patrol Dispatcher and ITS Operator.

5.1.6 Service Patrol Operator

The Service Patrol Operator is the operator of the MDOT service patrol vehicles. The Service Patrol Operator is primarily responsible for motorist assistance, removal or debris, assisting emergency personnel at incident sites, first responder activities when first on an incident scene and traffic control during incidents and major events. The Service Patrol Operators will have access to the Computer Aided Dispatch (CAD) subsystem of the ITS through wireless links and will receive and enter incident and event related information to the CAD and incident management subsystems. Service Patrol Operators will access the systems reports subsystem to enter service patrol information and receive service patrol performance data. As service patrol vehicles are equipped with AVL technology, operators will be able to monitor vehicle and operator status.

5.1.7 ITS Operator Trainee

The ITS Operator Trainee is a user that will eventually become an operator after a certain period of training and demonstrating that a defined level of competence has been acquired in operating the ITS. ITS Operator Trainees will work with one or more operators during their training cycle.

The ITS Operator Trainee will initially work on a separate system running in the simulation mode. As an operator receives system data, including incident information, the trainee will receive identical data. The Trainee will perform system inputs to build incident responses and traveler information outputs in parallel with their assigned operator. The response and traveler information outputs will be compared for accuracy and completeness. All response plans and traveler information responses will be approved by the operator before being executed by the system. When a trainee has acquired the necessary skills to operate the ITS the trainee will be promoted to operator.

5.1.8 ITS Maintenance Staff

ITS Maintenance Staff are primarily responsible for the maintenance of the ITS field hardware and communications infrastructure. They will access the ITS to test, install and configure field equipment and to receive and respond to work orders, manage inventory and create reports related to equipment performance, readiness and utilization. They will access the lane closure functions to enter and modify data related to closures where they may need to install or maintain ITS field components.

5.1.9 Construction and Maintenance

Construction and Maintenance personnel will have access to the ITS to enter and modify planned and unplanned roadway restriction and closure information. Construction and Maintenance users may update restriction and closure information

to affect response plan activities and to modify closure information displayed on the MDOT web site and in other traveler information subsystems. These users will have access to view system status and video to monitor roadway status affecting their work activities. When given appropriate permission by System Administrators these users will be able to respond to individual notifications through the web interface.

5.1.10 Internal Web User

The internal MDOT ITS web user will have viewing access to ITS system information, video images, incident and restriction information and all response notification information. Web users given appropriate permission by System Administrators will be able to respond to individual notifications through the web interface. No control access will be provided through the web application.

5.1.11 Archive Data User

There will be multiple internal and external users of data produced by the MDOT ITS. The MDOT ITS will provide for a data archive that will log traffic data and system information on a routine basis. The archived data will be dynamically configurable by system administrators and selected data will be routinely placed in an externally accessible data store, in a published format. Users given appropriate privileges to the external data store by system administrators may download the archived data for their use.

5.1.12 Media User

Various forms of media including broadcast and print media will be partners and users of the MDOT ITS. The ITS will provide video images in both snapshot format and full motion video format for broadcast media access. Where individual agreements are reached with media outlets, the ITS will provide email and/or electronic fax text messages of incident and restriction information based upon profile information provided by the individual media outlet. All other information provided to the print or broadcast media will go through the Division of External Affairs. Media users will not be granted any control access to the ITS.

5.1.13 Observer

An Observer user will be able to control cameras when those cameras are not under the control of an operator or ITS Engineer. Observers will be able to view camera images, incident status information and other traffic condition and equipment status information. Observers may be internal to MDOT or may be employees of other agencies that utilize the ITS information for decision support functions such as 911 dispatching.

5.2 Traveler User Group (External)

Travelers are not currently listed as an ITS User Class, because they cannot access the functionality of the system to affect changes or control system components. Travelers represent an external user group that will interface with the MDOT ITS in various ways. Drivers will receive information from the ITS through visual observation of DMS and through broadcast messages from Highway Advisory Radio (HAR) located strategically along the roadway network. Travelers will also interface to the ITS by direct voice communications to obtain incident and roadway restriction information, based upon user selected options. Where travelers require assistance from Service Patrols or are reporting incidents or other roadway information they may select an option of speaking with an MDOT Operator.

Travelers will also continue to interface with the MDOT ITS through the MDOT web site, MSTRAFFIC.com. This site will continue to provide video images and will be expanded to include the ability to select individual DMS and to view the currently displayed message. Roadway restriction information will continue to be available and other incident information including location and roadway status will be displayed from the ITS database. External users will be able to view selected geographic areas and receive video images and incident and restriction information based upon their entered profile. No control capability will be allowed through the web application.

In the future, as the Statewide 511 system is implemented and as the Vehicle Infrastructure Integration (VII) initiative is expected to be implemented in vehicle sand along the roadways, MDOT may consider listing Travelers as an ITS User Group.

5.3 Interface to external systems (Future)

It is not envisioned that the MDOT ITS will include a fully integrated electronic interface to other systems during the ten year time horizon assumed for this Concept of Operations. Interface to operations such as 911, Airport Operations, transit properties and Commercial Vehicle Operations (CVO) are part of the long-term goals of the overall MDOT ITS. The use of data and communications standards during the development of the initial MDOT ITS will facilitate the future integration with these systems. Interfaces to these systems during this initial time horizon will be through the development of operations agreements, Standard Operating Procedures (SOPs) and facilitated communications by way of voice, email and fax.

6. System Overview

"The Concept of Operations assumes a ten (10) year planning horizon and this concept is representative of potential ITS development by MDOT during that time horizon."

During the planning stages for the Statewide ITS, MDOT used the National ITS Architecture to lead the discussions to develop the Statewide and Regional architectures for Mississippi. It was determined that the utilization of the User Service Bundles and Market Packages identified in the Statewide and Regional architectures, that were directly applicable to the MDOT concept, would be customized for MDOT and included in the Concept of Operations. The utilization of these Market Packages, with their subsystems and equipment packages, provides for the later utilization of the National ITS Architecture process specifications as a basis for the development of systems requirements.

The individual Market Packages and descriptions that follow have been tailored to meet MDOT needs and to define the major system components, interconnection between these components and interfaces to external systems. Figure 6.1 below shows the basic elements of the market package diagrams.

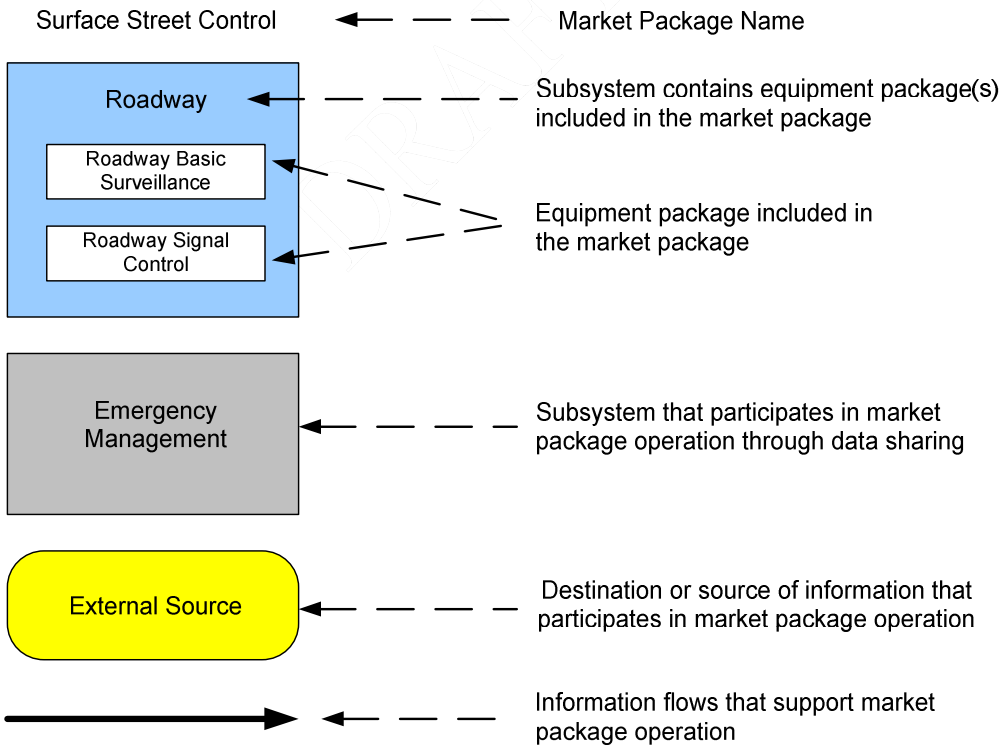


Figure 6.1 - Elements of the National ITS Architecture Market Packages

6.1 Market Packages

The market packages are presented in the order utilized by the National Architecture and this order does not imply any prioritization to the system. The first paragraph of each section contains the market package description directly from the National Architecture. This text is provided to establish the context for the MDOT tailored diagrams and descriptions that follow. The text that follows and the MDOT tailored diagram provide details of how the MDOT ITS will provide specific services. References to MDOT in the diagrams and the text are intended to represent the overall MDOT ITS system and the MDOT personnel that are responsible for operating, maintaining and interfacing with the system. As indicated previously, the Concept of Operations assumes a ten (10) year planning horizon and this concept is representative of potential ITS development by MDOT during that time horizon.

Where applicable, the operational status of each freeway device will be obtained on a periodic basis to determine if the device, or its communications link, requires maintenance. When a device requires maintenance, it will be reported to the ITS Maintenance function. This reporting may be done automatically by the software or manually by a MDOT operator. MDOT ITS maintenance personnel will be notified of the needed repairs via work orders. ITS maintenance personnel will update the work orders as necessary and the operations personnel will be notified when the field equipment has been repaired and is operational.

6.1.1 MDOT Data Mart (AD1)

The following is the ITS Data Mart (AD1) Market Package description from the National Architecture.

This market package provides a focused archive that houses data collected and owned by a single agency, district, private sector provider, research institution, or other organization. This focused archive typically includes data covering a single transportation mode and one jurisdiction that is collected from an operational data store and archived for future use. It provides the basic data quality, data privacy and meta data management common to all ITS archives and provides general query and report access to archive data users.

The MDOT ITS Data Archive concept is depicted in Figure 6.2. The MDOT ITS will perform data archiving by archiving data from all systems that are integrated into the MDOT TMC/TOCs to the same data store. Data archived by the MDOT ITS will not be directly accessible to external systems. Data warehousing is a future planned capability of the overall Mississippi ITS program and the MDOT ITS will participate in the ITS Data Warehouse when that capability is developed.

The MDOT ITS data archive will allow for different data formats and will be dynamically configurable by MDOT System Administrators. The system will log major system events, traffic data and will log operator activity to provide for accountability.

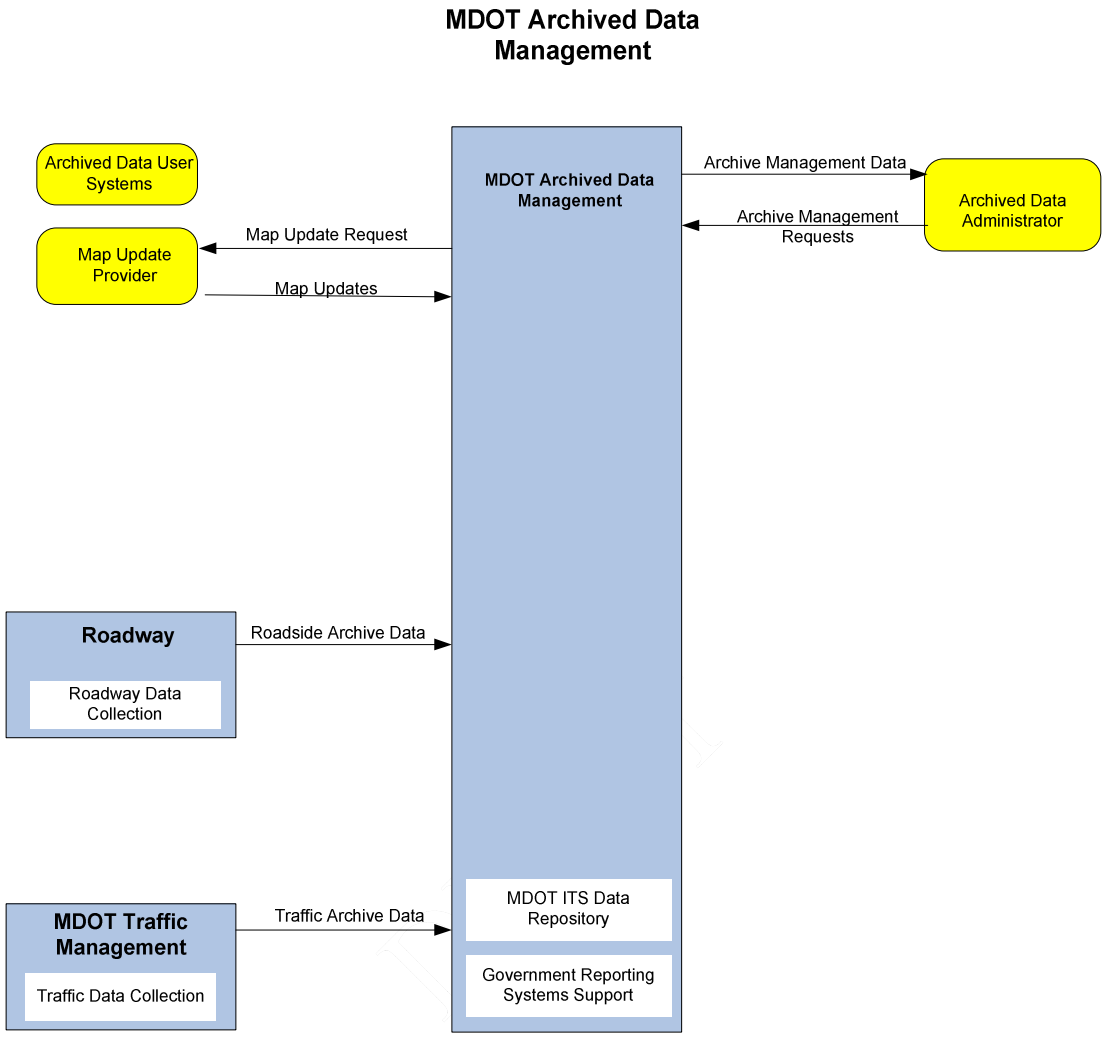


Figure 6.2 - MDOT ITS Data Archive Concept

6.1.2 Interactive Traveler Information (ATIS02)

The following is the Interactive Traveler Information (ATIS02) Market Package description from the National Architecture.

This market package provides tailored information in response to a traveler request. Both real-time interactive request/response systems and information systems that "push" a tailored stream of information to the traveler based on a submitted profile are supported. The traveler can obtain current information regarding traffic conditions, roadway maintenance and construction, transit services, ride share/ride match, parking management, detours and pricing information. A range of two-way wide-area wireless and fixed-point to fixed-point communications systems may be

used to support the required data communications between the traveler and Information Service Provider. A variety of interactive devices may be used by the traveler to access information prior to a trip or en route including phone via a 511-like portal, kiosk, Personal Digital Assistant, personal computer and a variety of in-vehicle devices. This market package also allows value-added resellers to collect transportation information that can be aggregated and be available to their personal devices or remote traveler systems to better inform their customers of transportation conditions. Successful deployment of this market package relies on availability of real-time transportation data from roadway instrumentation, transit, probe vehicles or other means. A traveler may also input personal preferences and identification information via a "traveler card" that can convey information to the system about the traveler as well as receive updates from the system so the card can be updated over time.

The MDOT interactive traveler information concept is depicted in two figures. Figure 6.3 shows MDOT utilizing an external ISP to manage interactive traveler information. In this instance MDOT is simply a supplier of information to the ISP and the ISP is responsible for gathering data from other sources and providing the consolidated data to satisfy traveler requests. Figure 6.4 is a representation of the interactive traveler information concept with MDOT as its own ISP.

In the second instance, shown in Figure 6.4, MDOT will act as its own ISP since it will provide interactive traveler information such as incident information, lane closure information, traffic video, DMS content and travel times through its web site (MSTraffic.com). The MDOT web site will provide for custom presentation of available data based upon input of profiles by the individual user. Profiling will allow for the customization of data presentation by geographic area, time of day and day of week and selection of types of available data to be displayed. In the diagram, personal computers and Personal Digital Assistants (PDA) are represented by the Personal Information Access subsystem. MDOT will provide links from its web site, MSTraffic.com where travelers may obtain static information, such as Transit fare and route information. In the diagram, this type link is shown as a one-way data flow to Transit Management. Links to other transportation providers will be provided as appropriate.

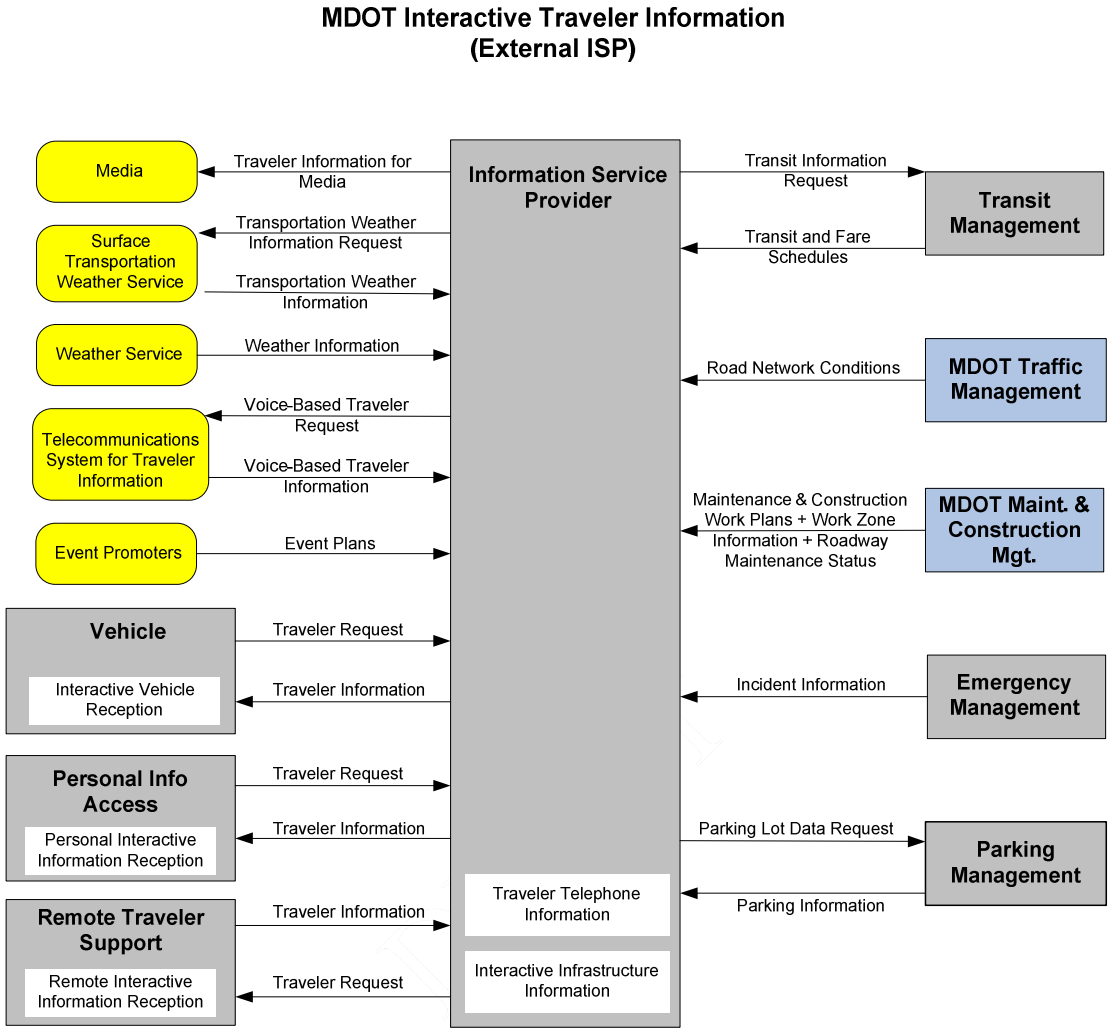


Figure 6.3 – Interactive Traveler Information Concept Provided by an ISP

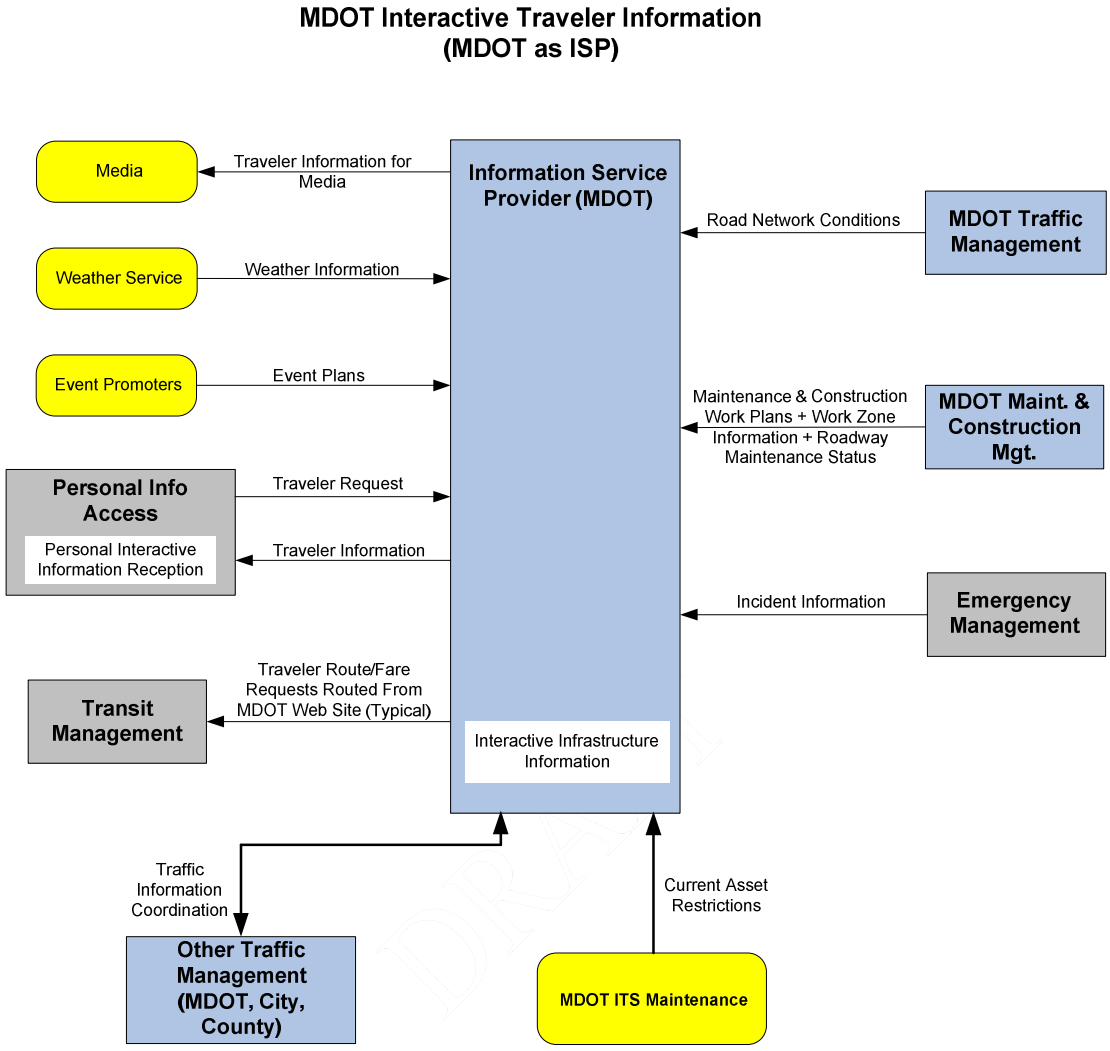


Figure 6.4 - Interactive Traveler Information Concept with MDOT as its own ISP

6.1.3 Network Surveillance (ATMS01)

The following is the Network Surveillance (ATMS01) Market Package description from the National Architecture.

This market package includes traffic detectors, other surveillance equipment, the supporting field equipment and fixed-point to fixed-point communications to transmit the collected data back to the Traffic Management Subsystem. The derived data can be used locally such as when traffic detectors are connected directly to a signal control system or remotely (e.g., when a CCTV system sends data back to the Traffic Management Subsystem). The data generated by this market package enables traffic

managers to monitor traffic and road conditions, identify and verify incidents, detect faults in indicator operations and collect census data for traffic strategy development and long range planning. The collected data can also be analyzed and made available to users and the Information Service Provider Subsystem.

The MDOT network surveillance concept is depicted in Figure 6.5. The MDOT ITS will monitor roadway performance and detect incidents and other events utilizing both intrusive (embedded loop detection) and non-intrusive (video imaging, infrared, radar, etc.) traffic detection technologies. Traffic detectors will include those connected to traffic signal control equipment as well as stand-alone detectors connected directly to the MDOT ITS. Environmental sensors will also be used where appropriate to detect roadway surface conditions and the presence of fog. The MDOT system will utilize video images monitored by system operators to detect and verify system performance, incidents and other events impacting the roadway system operation. Service Patrols will also serve to monitor system operations and performance and will serve as an additional surveillance tool by reporting system status, incident information and other event information that impacts roadway network performance.

Data collected by the Network Surveillance sub-system will be provided to the Archive Data Management sub-system for utilization in long range planning and will be made available to other users. Roadway network condition data may be made available to external ISPs for redistribution to travelers and other users. Additionally, video images will be shared with other transportation service providers and emergency services for surveillance and management use.

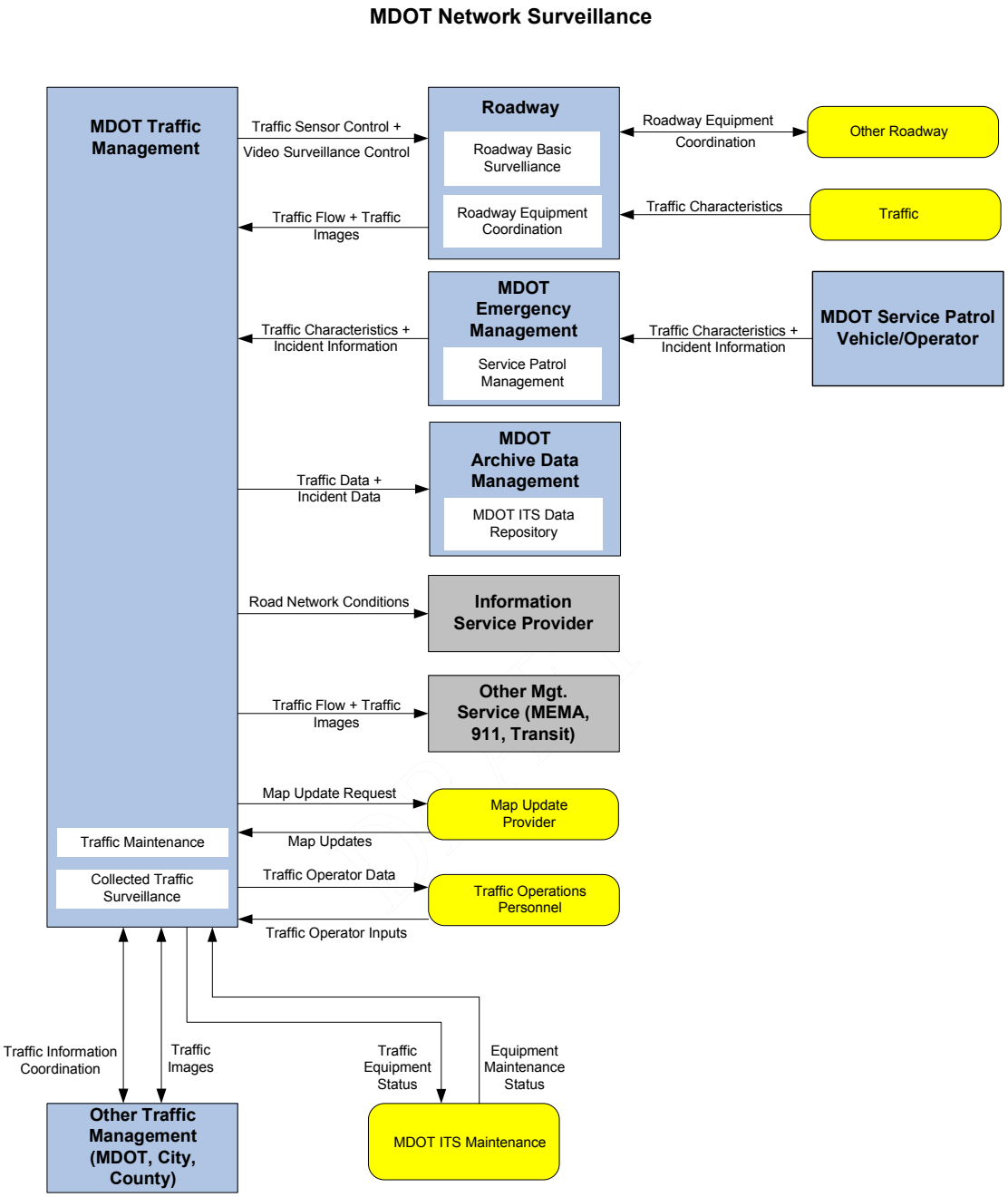


Figure 6.5 - MDOT Network Surveillance Concept

6.1.4 Surface Street Control (ATMS03)

The following is the Surface Street Control (ATMS03) Market Package description from the National Architecture.

This market package provides the central control and monitoring equipment, communication links and the signal control equipment that support local surface street control and/or arterial traffic management. A range of traffic signal control systems are represented by this market package ranging from fixed-schedule control systems to fully traffic responsive systems that dynamically adjust control plans and strategies based on current traffic conditions and priority requests. Additionally, general advisory and traffic control information can be provided to the driver while en route. This market package is generally an intra-jurisdictional package that does not rely on real-time communications between separate control systems to achieve area-wide traffic signal coordination. Systems that achieve coordination across jurisdictions by using a common time base or other strategies that do not require real time coordination would be represented by this package. This market package is consistent with typical urban traffic signal control systems.

The MDOT Surface Street Control concept is depicted in Figure 6.6. MDOT ITS Operators will monitor surface streets by way of roadway sensors, video, traffic signal status and other sources. The MDOT ITS will utilize network surveillance information to control MDOT owned signals, signs, sensors, meters and other surface street control equipment by both direct communications and field installation of equipment control parameters. These control devices will receive control data and present information to drivers and pedestrians to implement control strategies. Transit vehicle priority requests, like emergency vehicle preemption requests, will be handled at the field controller level and monitored by the MDOT system where communications to field controllers exists. Transit vehicle monitoring is currently outside of the MDOT concept but may be accomplished by other public transportation agencies and transit operators. Sharing of control of field equipment between MDOT and other agencies (cities or counties) will be accommodated by the system based upon privileges granted by the field equipment owners. At a minimum all agencies with system access shall be able to view available field equipment status.

The operational status of each roadway device will be obtained on a periodic basis to determine if the device or its communications link requires maintenance. When a device requires maintenance, it will be reported to the Construction and Maintenance function. This reporting may be done automatically by the software or manually by a MDOT operator. MDOT ITS maintenance personnel will be notified of the needed repairs via work orders. ITS maintenance personnel will update the work orders as necessary and the operations personnel will be notified when the field equipment has been repaired and is operational.

The MDOT ITS will coordinate traffic control information with other TMCs/TOCs to implement regional control strategies where appropriate. Traffic information will also be obtained from other sources, such as airports, where possible.

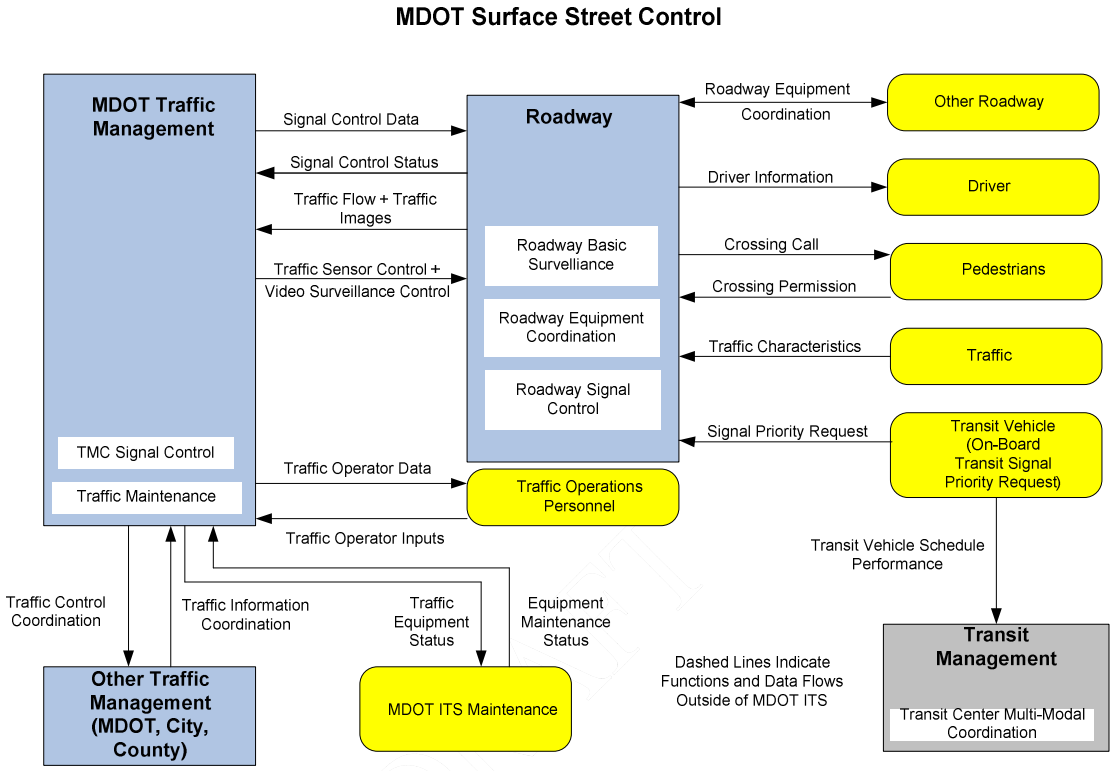


Figure 6.6 – MDOT Surface Street Control Concept

6.1.5 Freeway Control (ATMS04)

The following is the Freeway Control (ATMS04) Market Package description from the National Architecture.

This market package provides central monitoring and control, communications and field equipment that support freeway management. It supports a range of freeway management control strategies including ramp metering, interchange metering, mainline lane controls, mainline metering and other strategies including variable speed controls. This package incorporates the instrumentation included in the Network Surveillance Market Package to support freeway monitoring and adaptive strategies as an option. This market package also includes the capability to utilize surveillance information for detection of incidents. Typically, the processing would be performed at a traffic management center; however, developments might allow for point detection with roadway equipment. For example, a CCTV might include the capability to detect an incident based upon image changes. Additionally, this market

package allows general advisory and traffic control information to be provided to the driver while en route.

The MDOT Freeway Control concept is depicted in Figure 6.7. MDOT ITS Operators will monitor Freeways by way of Roadway sensors, video and other sources. This information will be sent to the driver via message signs or by other means available through the Traffic Information Dissemination subsystem (See ATMS06).

The MDOT ITS will utilize network surveillance information to control MDOT owned signs, sensors, meters and other freeway control equipment by both direct communications and field installation of equipment control parameters. These control devices will receive control data and present information to drivers to implement control strategies. At a minimum all agencies with system access shall be able to view available field equipment status.

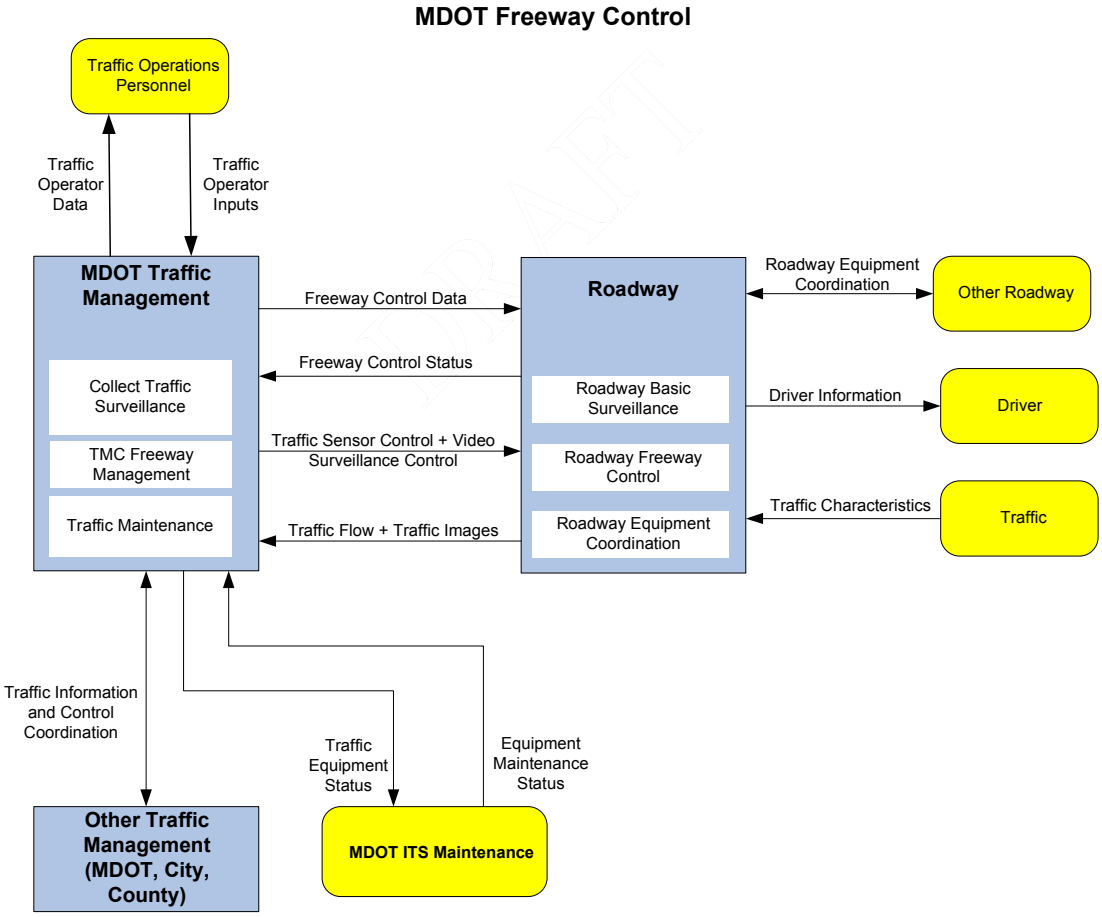


Figure 6.7 - MDOT Freeway Control Concept

MDOT Traffic Engineers will develop and maintain response plans for both normal operations as well as for other defined situations such as weather events, homeland security threats or AMBER Alerts, for example. MDOT ITS Operators will determine when to change from normal response plans to other defined response plans as well as when to return to normal response plans again.

The MDOT ITS will coordinate traffic control information with other TMCs/TOCs to implement regional control strategies where appropriate.

6.1.6 MDOT Traffic Information Dissemination (ATMS06)

The following is the Traffic Information Dissemination (ATMS06) Market Package description from the National Architecture.

This market package provides driver information using roadway equipment such as dynamic message signs or highway advisory radio. A wide range of information can be disseminated including traffic and road conditions, closure and detour information, incident information and emergency alerts and driver advisories. This package provides information to drivers at specific equipped locations on the road network. Careful placement of the roadway equipment provides the information at points in the network where the drivers have recourse and can tailor their routes to account for the new information. This package also covers the equipment and interfaces that provide traffic information from a traffic management center to the media (for instance via a direct tie-in between a traffic management center and radio or television station computer systems), Transit Management, Emergency Management and Information Service Providers. A link to the Maintenance and Construction Management subsystem allows real time information on road/bridge closures due to maintenance and construction activities to be disseminated.

The MDOT Traffic Information Dissemination concept is depicted in Figure 6.8. The MDOT ITS will disseminate information to drivers via the roadway subsystem using DMSs and HAR. The DMSs will be placed at strategic locations to inform traffic of upcoming conditions and will display information regarding incidents, congestion, construction and maintenance lane closures or restrictions, air quality alerts, traffic safety messages, travel times and wide area alerts related to evacuations, disasters or AMBER Alerts. Travel time messages are a future planned capability that will be automatically generated and updated based upon calculations from speed data from roadway sensors.

The MDOT system will use HARs to transmit low power radio signals containing traveler information supplemental to DMS messages and for other locations where DMSs may not exist. HAR messages will be generated automatically from system incident and emergency response plans using text-to-speech technology. ITS Operators will be able to edit, remove or add to the text that is generated before execution of the HAR messages and will be able to stop the execution of the HAR message outputs to individual HARs or groups of HARs. Operators will also be able to develop HAR messages within the system without reliance on the automated text generation from incident and emergency response plans.

The ITS will also disseminate information to the media through the use of automated email and fax capabilities and long-term may provide for the electronic connection of approved media users, such as television stations, with data and video viewing privileges. The implementation of a 511 system will also provide for traffic information dissemination through the 511 ISP who will be granted privileges that may range from viewing of data to the ability to input traveler reported data electronically. Privileges granted to the 511 ISP will be dependent upon contractual agreements between MDOT and the ISP and will be strictly monitored for compliance and conformance with all established system operational procedures.

MDOT Traffic Information Dissemination

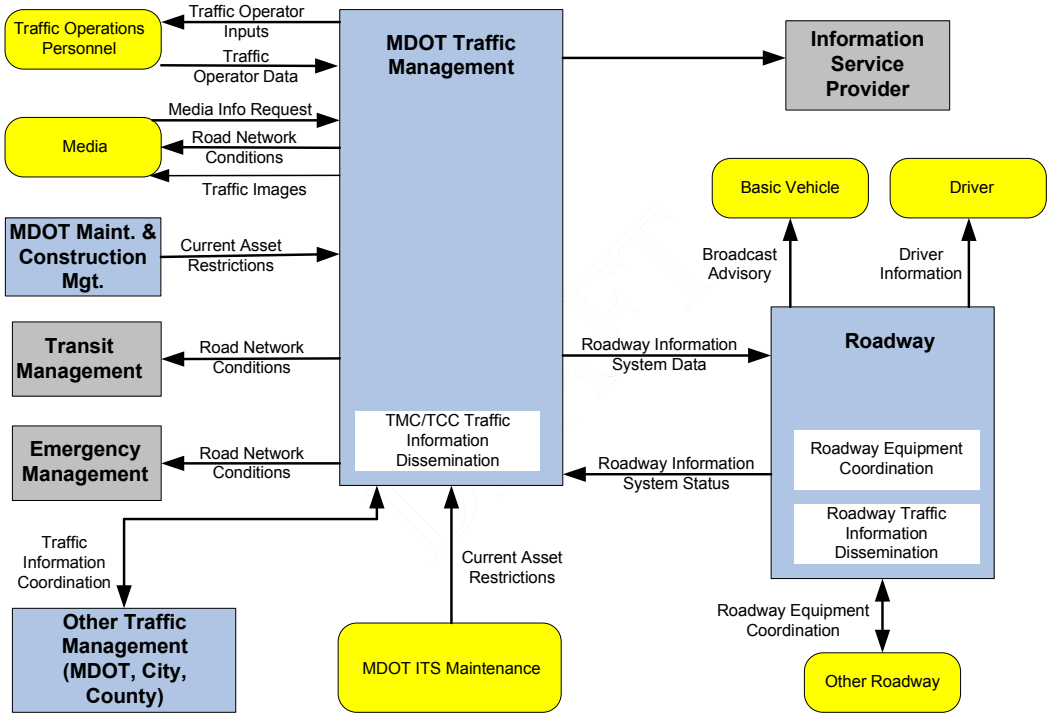


Figure 6.8 - MDOT Traffic Information Dissemination Concept

6.1.7 Regional Traffic Control (ATMS07)

The following is the Regional Traffic Control (ATMS07) Market Package description from the National Architecture.

This market package provides for the sharing of traffic information and control among traffic management centers to support a regional control strategy. This market package advances the Surface Street Control and Freeway Control Market Packages by adding the communications links and integrated control strategies that enable

integrated interjurisdictional traffic control. The nature of optimization and extent of information and control sharing is determined through working arrangements between jurisdictions. This package relies principally on roadside instrumentation supported by the Surface Street Control and Freeway Control Market Packages and adds hardware, software and fixed-point to fixed-point communications capabilities to implement traffic management strategies that are coordinated between allied traffic management centers. Several levels of coordination are supported from sharing of information through sharing of control between traffic management centers.

The MDOT Regional Traffic Control concept is depicted in Figure 6.9. The MDOT regional traffic control concept embraces the MDOT regional operations centers as well as other traffic operation centers that are operated by local agencies and that control surface streets and freeways. The concept centers upon the development of MDOT system software that will be utilized within all MDOT ITS operations centers. This will provide for seamless coordination of operations and information within MDOT ITS. The concept is extended to local agency operations centers by making the MDOT ITS available to the local agencies through license agreements. Utilization of the same ITS software will allow for coordination of operations and information with all participating agencies.

Sharing of field device control will be accomplished through an ITS Resource sharing MOA between MDOT and other participating agencies. This will be facilitated by the utilization of the MDOT ITS as well as standardization of field control equipment and standardized communications and data transfer protocols.

Within MDOT it is expected that the central point of contact for the MDOT ITS will be located in the Jackson TMC. This TMC will act as the Statewide TMC and will provide for after hours backup of other MDOT TMCs. The Statewide TMC will have field equipment operational control of all networked MDOT ITS field assets when other MDOT TMCs are not operational. Individual Regional TMCs in various MDOT Districts will retain control of their field devices when operational. The Statewide TMC will be connected to other MDOT Regional TMCs by a combination of dedicated MDOT owned communications assets (fiber and wireless) and leased communications capacity ranging from T1 (1.544Mbit/s) to T3 (44.736Mbit/s). Communications links to other agency operations centers will be over any combination of agency owned communications assets, leased communication capacity and Virtual Private Network (VPN) technologies.

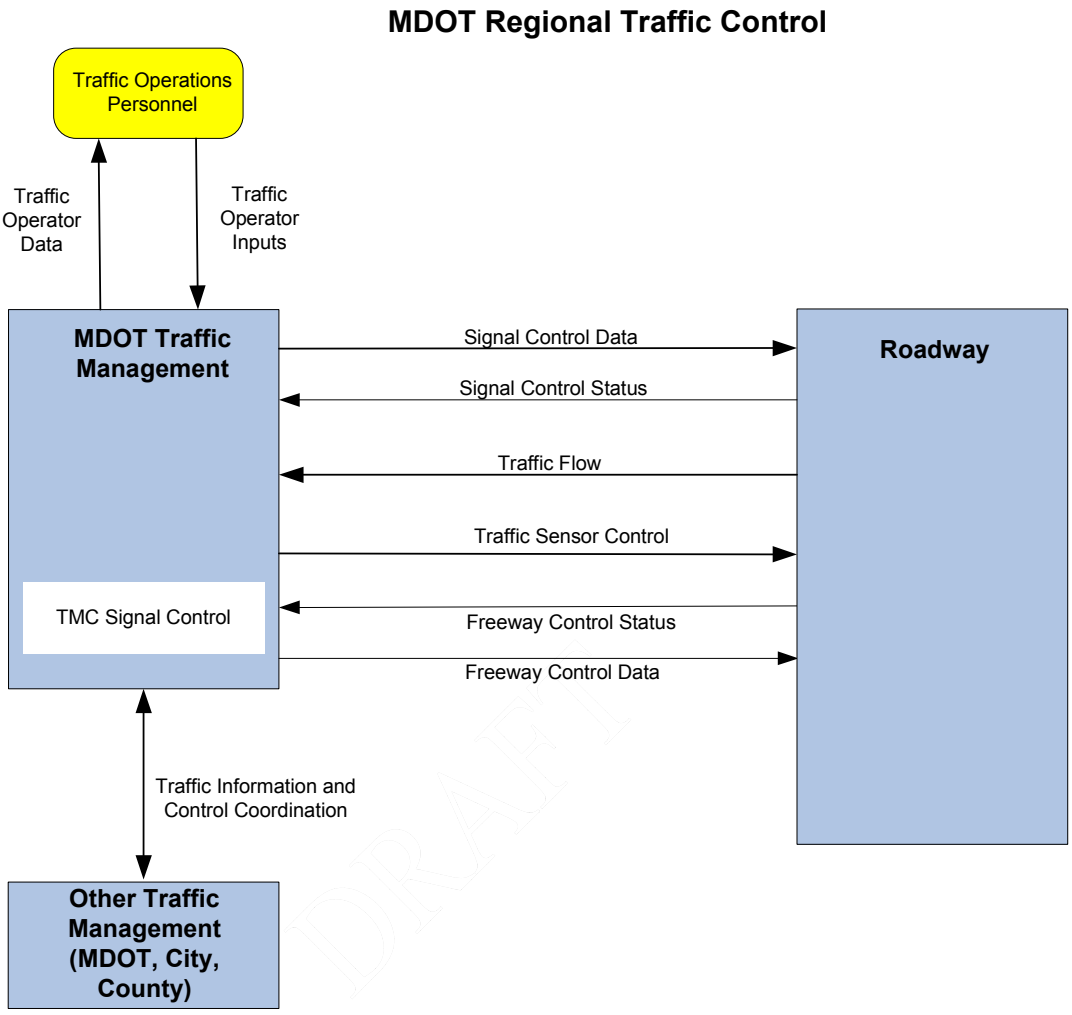


Figure 6.9 - Regional Traffic Control Concept

6.1.8 Traffic Incident Management (ATMS08)

The following is the Incident Management (ATMS08) Market Package description from the National Architecture.

This market package manages both unexpected incidents and planned events so that the impact to the transportation network and traveler safety is minimized. The market package includes incident detection capabilities through roadside surveillance devices (e.g. CCTV) and through regional coordination with other traffic management, maintenance and construction management and emergency management centers as well as rail operations and event promoters. Information

from these diverse sources is collected and correlated by this market package to detect and verify incidents and implement an appropriate response. This market package supports traffic operations personnel in developing an appropriate response in coordination with emergency management, maintenance and construction management and other incident response personnel to confirmed incidents. The response may include traffic control strategy modifications or resource coordination between center subsystems. Incident response also includes presentation of information to affected travelers using the Traffic Information Dissemination market package and dissemination of incident information to travelers through the Broadcast Traveler Information or Interactive Traveler Information market packages. The roadside equipment used to detect and verify incidents also allows the operator to monitor incident status as the response unfolds. The coordination with emergency management might be through a CAD system or through other communication with emergency field personnel. The coordination can also extend to tow trucks and other allied response agencies and field service personnel.

6.1.8.1 Incident Detection

MDOT operations personnel working in the TMCs will detect that incidents have occurred from the following sources:

- Traffic images – While periodically examining a section of roadway, an operator may detect that an incident has occurred.

- Traffic sensors – Using input from the traffic sensors the system will detect potential incidents. Operators will verify the incident has occurred at a specific location by using system cameras.

- Roadway Service Patrol drivers – Service patrol drivers respond to drivers in need and verify that an incident exists. Examples include flat tires and stalled vehicles. At this point there are two possible alternatives for accomplishing the data entry.
  - Alternative 1: The driver logs the incident into their manual logs and calls the incident into the TMC via radio. TMC operators enter the incident information into the system.
  - Alternative 2: The driver enters the incident information into their wireless device and the information is automatically transmitted to the TMC updating the incident logs and all related subsystems.

- Service Patrol calls – Drivers call directly into the Service Patrol number and one of two methods of data entry occurs.
  - Alternate 1: The service patrol operator contacts the TMC operator and the TMC operator enters the incident information into the system.
  - Alternate 2: The service patrol operator enters the incident information into the MDOT system.

- 911 calls – Drivers are involved in an incident or discover an incident and call 911. The incident information is input into the 911 system. At this point two alternatives exist for accomplishing the data entry into the incident management system.
  - Alternative 1: The 911 system automatically notifies the MDOT system.
  - Alternative 2: The 911 operator contacts MDOT via voice, FAX or email with the incident information.
  - Alternative 3: TMC operators monitoring the 911 CAD System discovers that an incident has occurred and enters the information into the MDOT system.

- Area-wide event calendar – The MDOT system is notified of planned events that will affect traffic and operators implement response plans.

- Lane closure – Lane closures that are entered into the MDOT Construction and Maintenance Management system are automatically handled as planned incidents with appropriate pre-determined system response plans.

- Weather service – The MDOT system implements a response plan based on current or upcoming weather conditions.

- External ISP – An Information Service Provider notifies the MDOT system of a verified incident meeting MDOT criteria. The incident is updated into the MDOT system.

- Travelers – The MDOT system includes a direct voice line for travelers to contact the TMC. Incidents are reported by travelers and there are standard verification criteria utilized by MDOT prior to entry of traveler derived incident information into the system. (This system may be handled by MDOT operators/call takers or long-term may utilize an automated answering system with voice recognition capabilities allowing the application of algorithms to screen and update incident information.) Additionally, with the implementation of a 511 system operated by an ISP, travelers may report incidents through the 511 system. Incident information may be sent from the 511 by voice contact between 511 operators to MDOT operators/call takers where the standard verification criteria utilized by MDOT would be applied prior to entry of the data into the incident management system. Long-term the incident data may be entered electronically into the 511 system and sent to the incident management system electronically. In this case algorithms will be applied to the electronic data to screen the incident information prior to its entry into the incident management system.

- Other TMCs or TOCs – The MDOT system is notified of an incident from another TMC or TOC.

The MDOT system will provide both visual and audible alarms when a potential incident is detected by the system. Such incidents will initially populate incident data fields with location and time stamp data. These alarms may be turned off and on at individual system work stations by authorized system users. Operators may also enter incidents into the system manually upon notification of an incident and may defer implementation of response plans pending verification either by the system or other operators with verification privileges. Incident management by operators, as well as response plan data entry and other related tasks will be divided geographically by 'logical sections.'

These 'logical sections' may be reconfigured by supervisors based upon workload or other factors as appropriate. This division of responsibilities will enable incident alarms and field device information within a section to be directed to the appropriate operator(s) assigned specified sections based upon operator login data.

6.1.8.2 Incident Response

MDOT operators will create an incident response utilizing the system software that generates the response based upon MDOT incident management standard operating procedure, incident type, incident location and field equipment location. An incident response is comprised of a plan where all field equipment commands may be executed or cleared simultaneously. If the response plan has previously been generated the system will present this response plan for verification and/or modification by the operator prior to execution. If the response plan has not been previously generated the system will provide a response plan for review, editing and execution by the operator. These plans may also be saved by operator choice for future use by the system. The operator will have the ability to choose the time of execution of a response plan and the duration of such execution. Any response plan may be modified or terminated, at any time, by the operator or others with appropriate system authority. The operator will also choose to automatically page, email and/or instant message certain personnel when the response is executed. The system will generate a list of personnel to be notified based upon incident information and notification criteria contained within the system database. These notifications may be edited or modified by the operator prior to execution by the system. The text content of the message to be sent will be automatically generated based upon the incident information and the response plan content. The message text may be edited prior to sending.

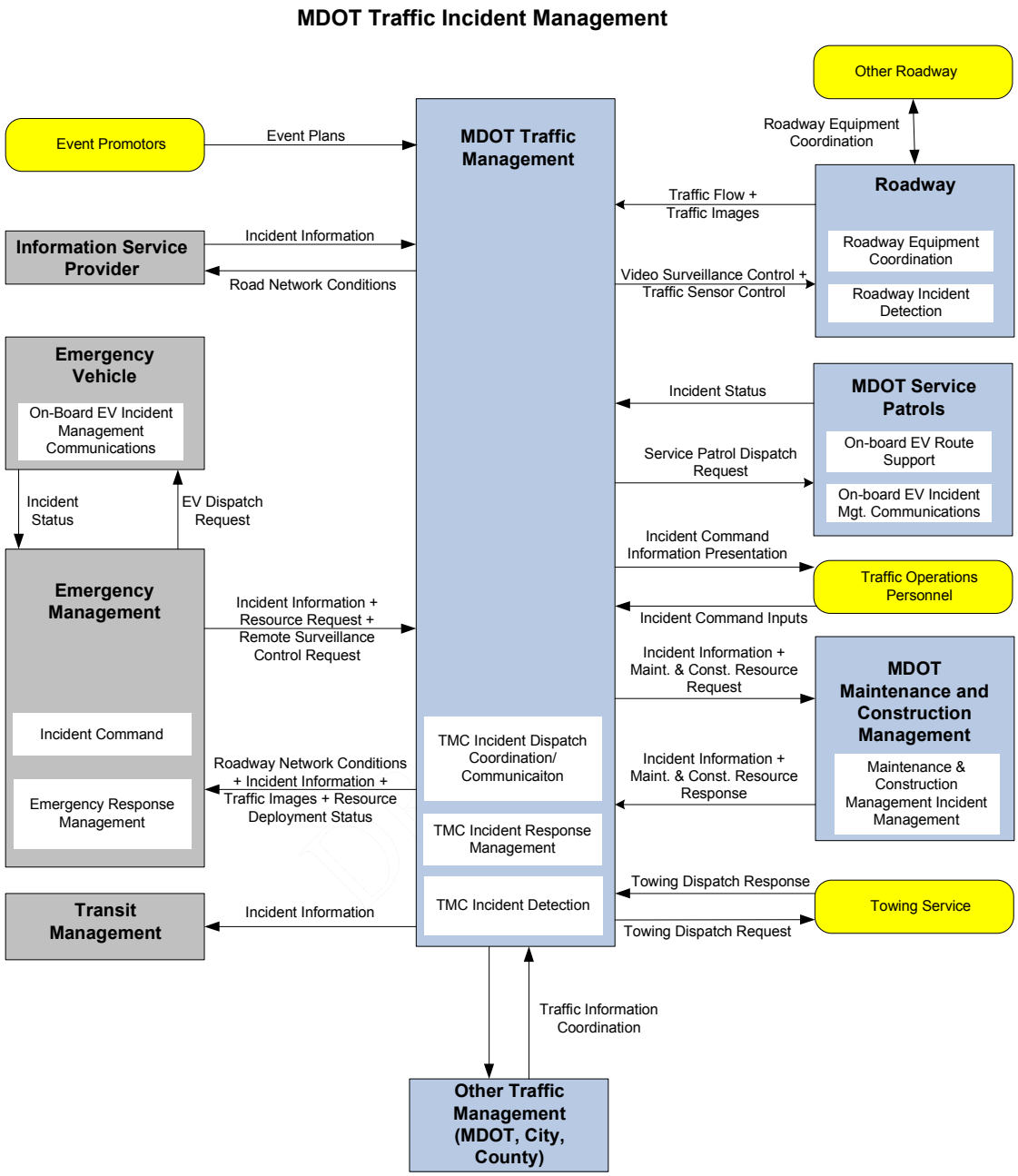
The incident detection and response plan sub-systems, in the future, will populate the MDOT Computer Aided Dispatch (CAD) sub-system used for dispatching service patrol resources. The CAD will select and display service patrol resources locations and availability based upon incident information and response plan generation. System operators may then select one or more service patrol resources for dispatch and those selected will be notified electronically by the CAD system. The incident management system will maintain logs of all service patrol dispatch activities and will update the incident database automatically.

The MDOT system will manage incident responses based on prioritization. The system operators will assign a priority to each response to insure that commands will be executed and removed in lieu of a higher or lower priority incident response. Example: A planned lane closure response plan is implemented based upon time of day. A major incident occurs within the area of the lane closure. The incident response plan will be executed over the lower lane closure plan. When the incident is modified or closed the lower priority response plan will automatically resume execution if the lower priority criteria are still in effect. Response plan generation will be maintained by updating, editing or modifying response plan rules associated with the MDOT incident response methodology and by updating, editing or modifying equipment location and command parameter information.

Incidents involving debris from vehicles or other sources will be coordinated with the appropriate city or county TOCs or other operational authorities as appropriate. Where clean-up is the responsibility of MDOT the system will notify the appropriate MDOT forces either electronically or by voice contact by system operators/dispatchers. Service patrols will be notified of detected debris and will respond based upon their operational priorities to complete debris removal or assist as appropriate. Incidents that are active within the system may not be terminated except under the following conditions:

- The incident is confirmed to be cleared and does not present the possibility of potential secondary incidents.
- The incident is confirmed to have been entered into the system in error.
- MDOT management exercises it's authority to remove the incident response from the system.

The MDOT-tailored Incident Management System concept is shown in Figure 6.10.



6.10 - MDOT Incident Management System Concept

6.1.9 Standard Railroad Grade Crossing (ATMS13)

The following is the Standard Railroad Grade Crossing (ATMS13) Market Package description from the National Architecture.

This market package manages highway traffic at highway-rail intersections (HRIs) where operational requirements do not dictate more advanced features (e.g., where rail operational speeds are less than 80 miles per hour). Both passive (e.g., the crossbuck sign) and active warning systems (e.g., flashing lights and gates) are supported. (Note that passive systems exercise only the single interface between the roadway subsystem and the driver in the architecture definition.) These traditional HRI warning systems may also be augmented with other standard traffic management devices. The warning systems are activated on notification by interfaced wayside equipment of an approaching train. The equipment at the HRI may also be interconnected with adjacent signalized intersections so that local control can be adapted to highway-rail intersection activities. Health monitoring of the HRI equipment and interfaces is performed; detected abnormalities are reported to both highway and railroad officials through wayside interfaces and interfaces to the traffic management subsystem.

The MDOT Standard Railroad Grade Crossing concept is depicted in Figure 6.11. The MDOT concept of standard railroad grade crossing control consists primarily of the interface of the MDOT ITS to traffic signal equipment adjacent to and interconnected with railroad wayside equipment. This interconnection of traffic signals to railroad wayside equipment typically takes the form of a relay closure provided by the railroad, upon detection of a train by railroad sensors. The MDOT ITS will provide for pre-determined pre-emption sequencing by adjacent traffic signals and the activation of appropriate DMS or blank-out signing that may be connected to that signal equipment. The MDOT system will be capable of controlling DMS that may be located near railroad grade crossings and that are not connected to traffic signal equipment, if these DMS have communications capability to the MDOT ITS. It may be possible for relay closures, provided by the railroad, to activate predetermined messages on DMS located adjacent to standard railroad crossings. MDOT ITS operators will be able to place messages on DMS and system response plans will be capable of providing messages for DMS when a railroad relay closure or other digital alarm provided by the railroad is activated in the MDOT ITS.

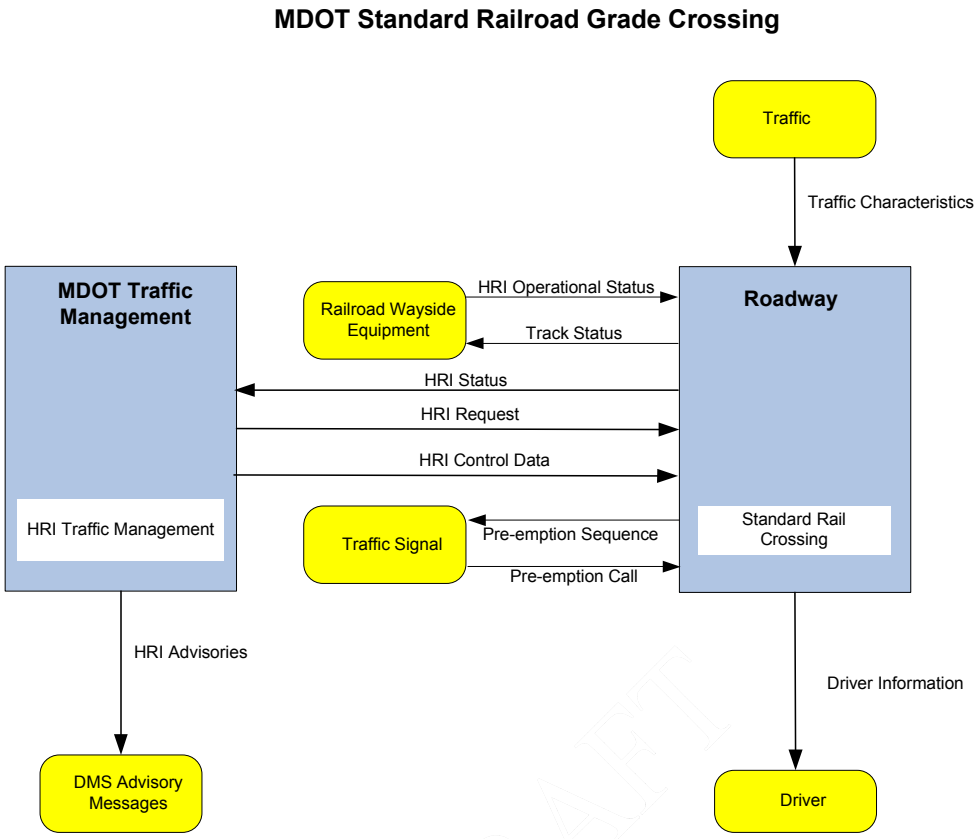


Figure 6.11 - MDOT Standard Railroad Grade Crossing Concept

6.1.10 Speed Monitoring (ATMS19)

The following is the Speed Monitoring (ATMS19) Market Package description from the National Architecture.

This market package monitors the speeds of vehicles traveling through a roadway system. If the speed is determine to be excessive, roadside equipment can suggest a safe driving speed. Environmental conditions may be monitored and factored into the safe speed advisories that are provided to the motorist. This service can also support notifications to an enforcement agency to enforce the speed limit on a roadway system.

The MDOT Speed Monitoring concept is shown in Figure 6.12 below. The MDOT system will be capable of configuring and controlling automated equipment installed along the roadway network that measures traffic volume, speed, density and other characteristics of the traffic stream. While detection of the speed of individual vehicles will be possible the MDOT system will not utilize collected vehicle speed data for speed enforcement purposes. Rather the MDOT system will monitor speeds for the purposes of detecting congestion, incidents and other network operational characteristics and for data input into incident detection algorithms and response plan algorithms.

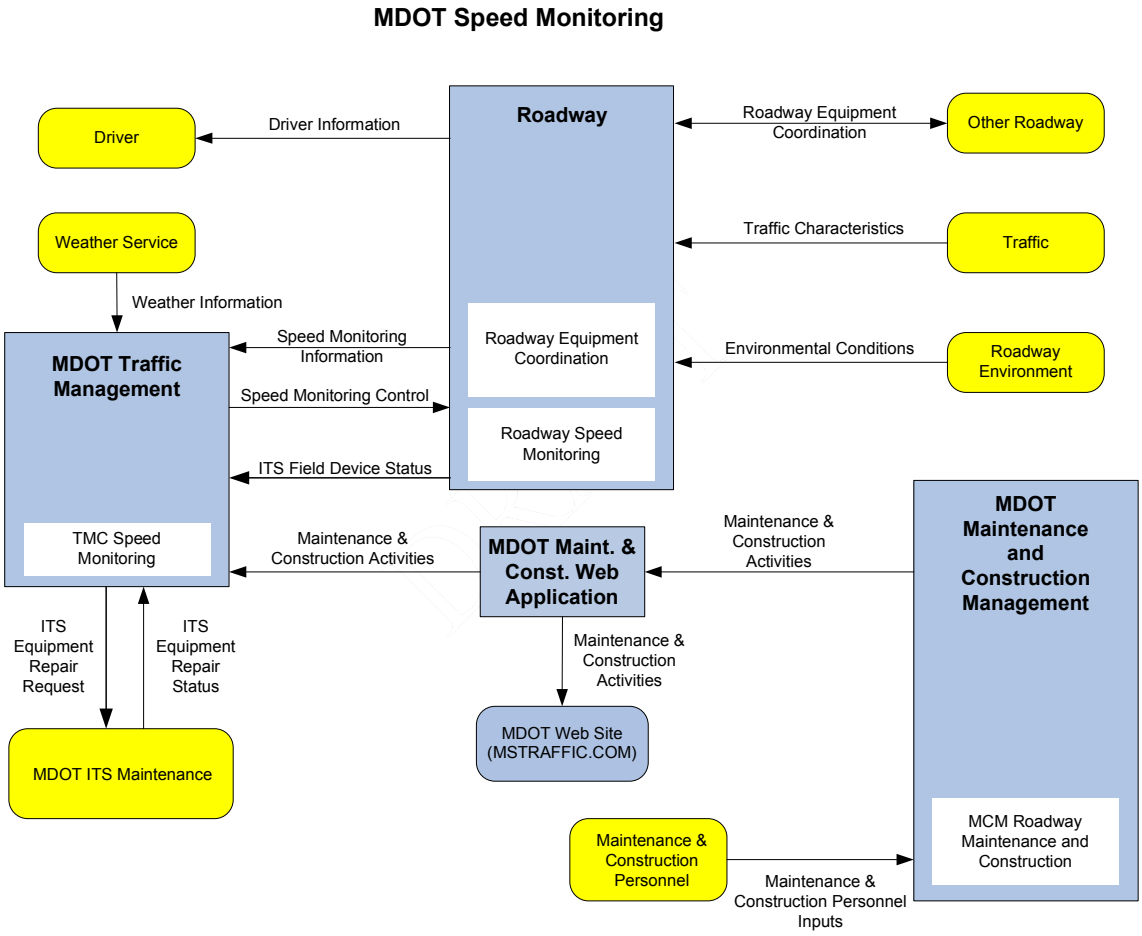


Figure 6.12 - MDOT Speed Monitoring Concept

The system will be capable of issuing speed advisories as a result of detected congestion, incidents and planned and unplanned events. Speed will also be monitored in conjunction with roadway environmental monitoring and speed advisories will be initiated by the system when environmental conditions necessitate

such warnings. Speed advisories will be issued through the Traffic Information Dissemination sub-system (see ATMS06). In the case of extreme environmental conditions, such as the detection of fog, the MDOT system may institute a change in speed limits through the use of variable speed limit signing in the affected areas. The MDOT system will monitor the speed monitoring system status including current operational state and logged information including measured speeds, advisory messages displayed, variable speed limit status and display and field equipment operational status.

As a point of clarification, speed monitoring done by MDOT is for traffic management and not for law enforcement purposes. That task is up to the local police departments and the Mississippi Highway Patrol, depending on the jurisdiction managing the roadway.

6.1.11 Roadway Closure Management (ATMS21)

The following is the Roadway Closure Management (ATMS21) Market Package description from the National Architecture.

This market package closes roadways to vehicular traffic when driving conditions are unsafe, maintenance must be performed and other scenarios where access to the roadway must be prohibited. The market package includes automatic or remotely controlled gates or barriers that control access to roadway segments including ramps and traffic lanes. Remote control systems allow the gates to be controlled from a central location or from a vehicle at the gate/barrier location, improving system efficiency and reducing personnel exposure to unsafe conditions during severe weather and other situations where roads must be closed. Surveillance systems allow operating personnel to visually verify the safe activation of the closure system and driver information systems (e.g., DMS) provide closure information to motorists in the vicinity of the closure. The equipment managed by this market package includes the control and monitoring systems, the field devices (e.g., gates, warning lights, DMS, CCTV cameras) at the closure location(s) and the information systems that notify other systems of a closure. This market package covers general road closure applications; specific closure systems that are used at railroad grade crossings, drawbridges, reversible lanes, etc. are covered by other ATMS market packages.

The MDOT concept of roadway closure management is shown in Figure 6.13. The MDOT concept does not currently include the utilization of any automated gates or barrier devices to accomplish roadway closures. Closures, whether accomplished for roadway maintenance purposes, incidents, planned events, emergencies or evacuation scenarios, are accomplished by manually placing closure devices at preplanned or event dictated locations. Personnel and vehicular resources from Construction and Maintenance, as well as Traffic Engineering, will be utilized to transport and place closure devices. The MDOT ITS will provide coordination of available closure information, roadway system data, video images and will provide roadway network condition information to external management functions and other users through the

Traffic Information Dissemination subsystem (see ATMS06). Where planned closures for special events are accomplished by others (example: parades, festivals, etc.) the MDOT ITS will monitor the closures and their effect on adjacent roadway network facilities and will continue to provide roadway network condition information through the Traffic Information Dissemination subsystem.

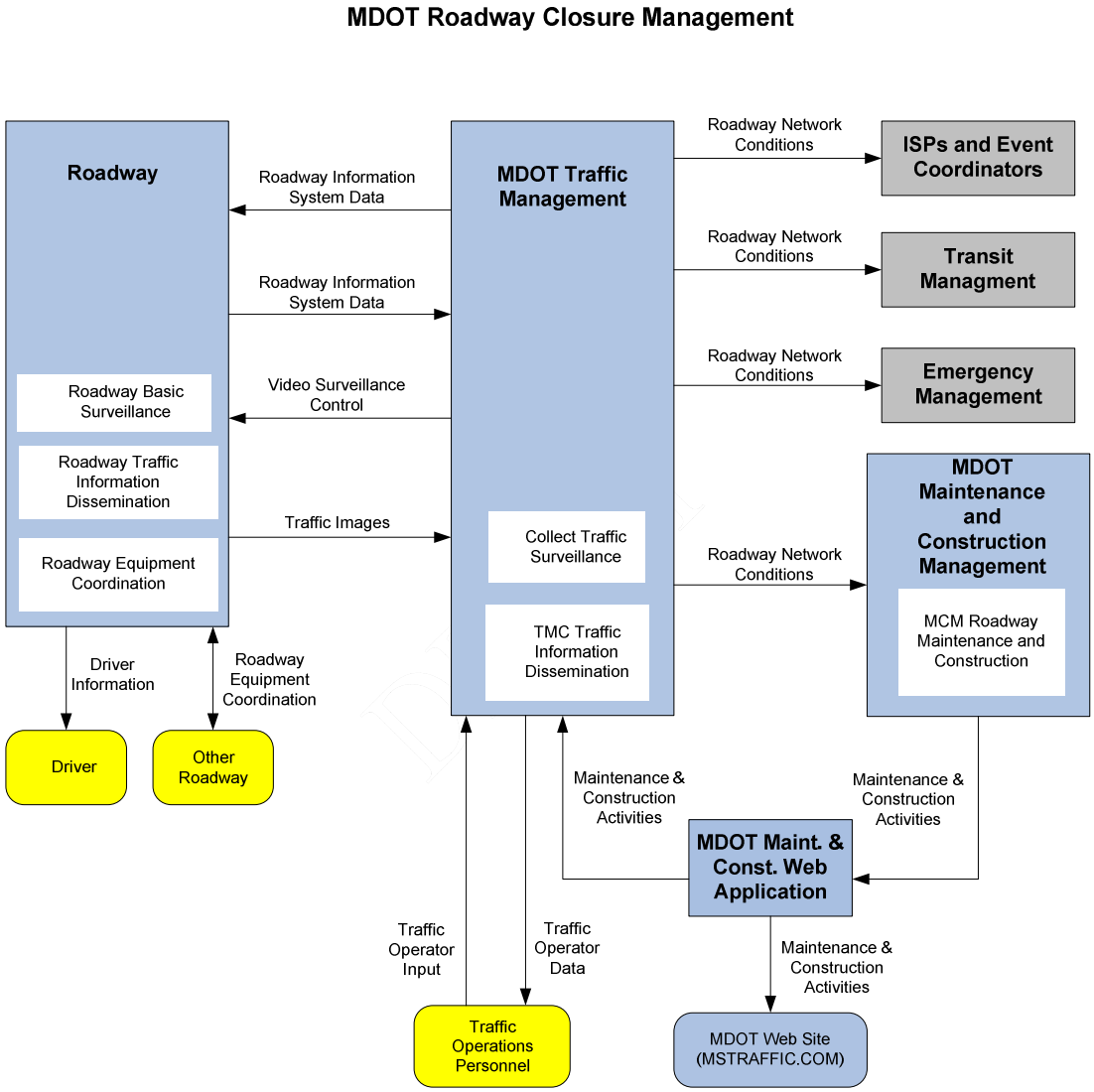


Figure 6.13 - MDOT Roadway Closure Management Concept

6.1.12 MDOT Roadway Service Patrols (EM04)

The following is the Roadway Service Patrols (EM04) Market Package description from the National Architecture.

This market package supports roadway service patrol vehicles that monitor roads to aid motorists, offering rapid response to minor incidents (flat tire, accidents, out of gas) to minimize disruption to the traffic stream. If problems are detected, the roadway service patrol vehicles will provide assistance to the motorist (e.g., push a vehicle to the shoulder or median). The market package monitors service patrol vehicle locations and supports vehicle dispatch to identified incident locations. Incident information collected by the service patrol is shared with traffic, maintenance and construction and traveler information systems.

Figure 6.14 shows the MDOT concept for service patrol operations. The service patrol units will be dedicated units owned and operated by MDOT or under contract to MDOT to provide specified services on the interstate highways and other major routs in their assigned service areas. The service patrols will be dispatched by the MDOT Service Patrol Operators at the TMC with the assistance of the ITS Service Patrol Management (CAD) sub-system. All Service Patrol vehicles will be equipped with Advanced Vehicle Location (AVL) systems and on-board wireless data terminals linked to the MDOT system. All service patrol vehicle operators will be equipped with voice communications units that allow voice communications to MDOT dispatch from the vehicle or when they are outside of the vehicle.

The primary mission of these units will be to assist in the clearance of incidents that block travel lanes by clearing debris, pushing or pulling disabled vehicles from the roadway and providing traffic control for other emergency responders to expedite incident clearance.

Most calls for service on the interstate highways are not emergencies requiring an emergency management response. The majority of calls are service-related in nature. For example, a driver has a flat tire or an engine malfunction rendering the vehicle inoperable and in need of a repair or tow. The disabled vehicle presents a hazard to the vehicle driver and to other vehicles using the affected roadway. Service patrol units will provide assistance in the form of tire changes, providing minimal gasoline, or pushing or pulling of the disabled vehicle to a safe location where private services may be obtained by the vehicle driver. Service patrol operators will be trained in first responder first aid and will be equipped to administer first aid as needed when they are the first responder to an incident scene.

MDOT Service Patrol Management will collect calls for service from stranded motorist via cell phone on a dedicated number such as *DOT and dispatch the appropriate service vehicle. The response times and what action is taken will be communicated from the Service Patrol Vehicle Operator or on-board computer back to MDOT Service Patrol Management where it will be entered into the ITS updating incident logs and response plans. Statistics on detection, response, clearance and recovery times will be collected for quality assurance and planning purposes.

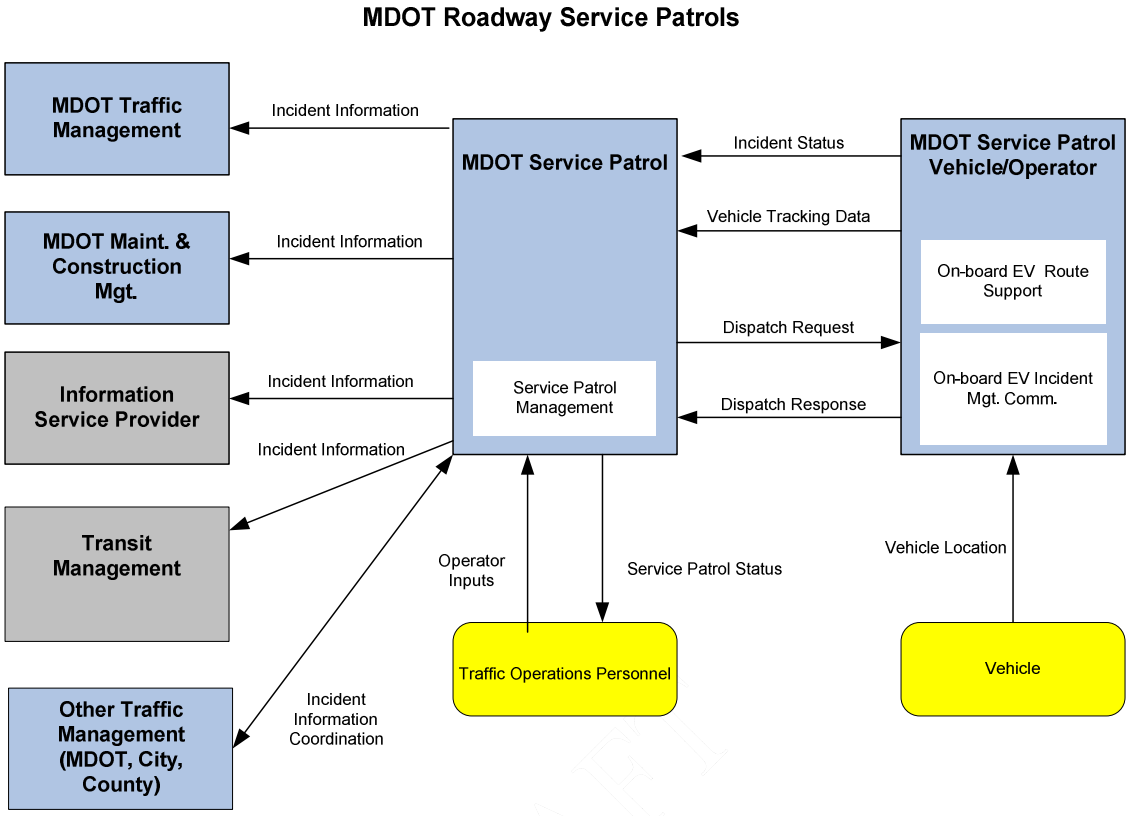


Figure 6.14 - MDOT Service Patrol Operations Concept

6.1.13 Wide Area Alert and Disaster Traveler Information (EM06 & EM10)

The following are the Wide Area Alert and Disaster Traveler Information market package descriptions from the National Architecture.

Wide Area Alert (EM06) - This market package uses ITS driver and traveler information systems to alert the public in emergency situations such as child abductions, severe weather events, civil emergencies and other situations that pose a threat to life and property. The alert includes information and instructions for transportation system operators and the traveling public, improving public safety and enlisting the public's help in some scenarios. The ITS technologies will supplement and support other emergency and homeland security alert systems such as the Emergency Alert System (EAS). When an emergency situation is reported and verified and the terms and conditions for system activation are satisfied, a designated agency broadcasts emergency information to traffic agencies, transit agencies, information service providers, toll operators and others that operate ITS systems. The ITS systems, in turn, provide the alert information to transportation system operators and the traveling public using ITS technologies such as dynamic message signs, highway

advisory radios, in-vehicle displays, transit displays, 511 traveler information systems and traveler information web sites.

Disaster Traveler Information (EM10) - This market package uses ITS to provide disaster-related traveler information to the general public, including evacuation and reentry information and other information concerning the operation of the transportation system during a disaster. This market package collects information from multiple sources including traffic, transit, public safety, emergency management, shelter provider and travel service provider organizations. The collected information is processed and the public is provided with real-time disaster and evacuation information using ITS traveler information systems.

A disaster will stress the surface transportation system since it may damage transportation facilities at the same time that it places unique demands on these facilities to support public evacuation and provide access for emergency responders. Similarly, a disaster may interrupt or degrade the operation of many traveler information systems at the same time that safety-critical information must be provided to the traveling public. This market package keeps the public informed in these scenarios, using all available means to provide information about the disaster area including damage to the transportation system, detours and closures in effect, special traffic restrictions and allowances, special transit schedules and real-time information on traffic conditions and transit system performance in and around the disaster.

This market package also provides emergency information to assist the public with evacuations when necessary. Information on mandatory and voluntary evacuation zones, evacuation times and instructions are provided. Available evacuation routes and destinations and current and anticipated travel conditions along those routes are provided so evacuees are prepared and know their destination and preferred evacuation route. Information on available transit services and traveler services (shelters, medical services, hotels, restaurants, gas stations, etc.) is also provided. In addition to general evacuation information, this market package provides specific evacuation trip planning information that is tailored for the evacuee based on origin, selected destination and evacuee-specified evacuation requirements and route parameters.

This market package augments the ATIS market packages that provide traveler information on a day-to-day basis for the surface transportation system. This market package provides focus on the special requirements for traveler information dissemination in disaster situations.

MDOT recognizes the similarities in the MDOT ITS operations related to dissemination of traveler information during normal transportation operations and during disaster response and recovery events or wide area alerts such as severe weather, child abductions (AMBER Alerts) or civil disturbances. The similarities are primarily the use of MDOT ITS resources to disseminate information. However, the

major difference in disaster traveler information and wide area alerts information dissemination and normal traveler information is the authority for the disbursement of some or all of the information, agreement on the content and the origin of some or all of the information. The diagram below (Figure 6.15) depicts the MDOT concept for wide area alerts and disaster and recovery information dissemination, as it relates to the MDOT ITS. In normal circumstances the MDOT ITS disperses traffic and traveler information, under its own authority, based upon its primary mission of managing traffic and the roadway network under its jurisdiction. In the case of disasters or wide area alert situations information is dispersed based upon pre-event planning and agreements or is developed in coordination with other agencies and authorities as the events unfold. Wide area alert information and disaster and evacuation information originate from Emergency Management systems outside of MDOT and are provided to MDOT for redistribution through its information dissemination subsystems. Normal traveler information dissemination may continue or be modified during these events, therefore, the ability of the ITS to integrate and prioritize the wide area alert and disaster information with its normal information dissemination and response plan activities is essential to effective and efficient operations.

In this concept diagram the Emergency Management subsystem represents the MDOT Emergency Management Coordinator and/or the Mississippi Emergency Management Agency. It should be noted that some dissemination capabilities normally utilized by MDOT ITS do not appear in this market package. One such data linkage is from the MDOT Traffic Management Service to Media providers. While video images may remain available to the media, other event information is normally dispersed to the media through emergency management outside of MDOT. It is also noted that the utilization of the MDOT web application (MSTRAFFIC.com) is included in this market package but does not appear in the Traveler Information Dissemination market package. The web application is normally shown in the Interactive Traveler Information package as “Personal Information Access” with information content supplied primarily by MDOT ITS resources. However, in the disaster and wide area alert situations the web application may be modified to include event information provided by emergency management to the MDOT ITS for redistribution.

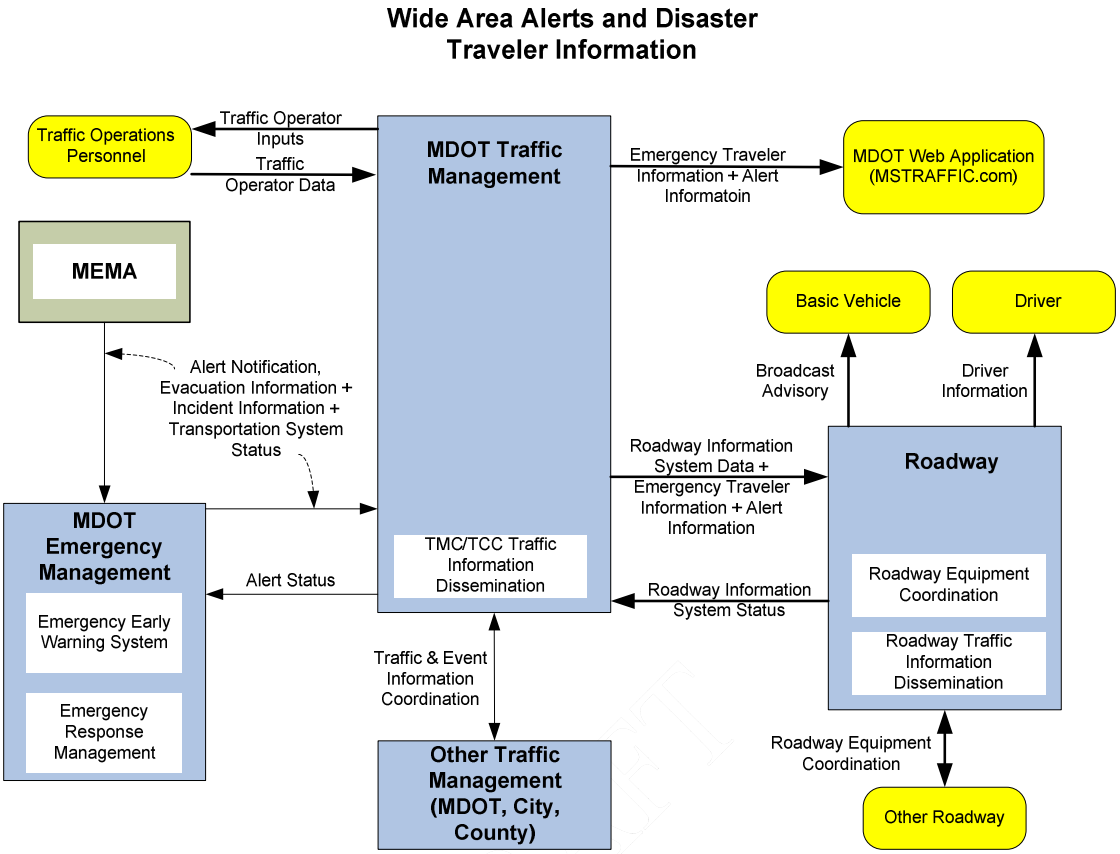


Figure 6.15 - MDOT Wide Area Alerts and Disaster and Recovery Information Dissemination Concept

6.1.14 Early Warning Systems (EM07)

The following is the Early Warning Systems Market Package (EM07) description from the National Architecture.

This market package monitors and detects potential, looming and actual disasters including natural disasters (hurricanes, earthquakes, floods, winter storms, tsunamis, etc.) and technological and man-made disasters (hazardous materials incidents, nuclear power plant accidents and acts of terrorism including nuclear, chemical, biological and radiological weapons attacks). The market package monitors alerting and advisory systems, ITS sensors and surveillance systems, field reports and emergency call-taking systems to identify emergencies and notifies all responding agencies of detected emergencies.

The MDOT ITS concept includes the utilization of surveillance and incident detection systems to monitor and detect potential, looming and actual disasters, whether natural or man-made and to inform Emergency Management (MEMA) of all incidents that meet established criteria for emergency management notification. The criteria for notification of MEMA will be determined with the assistance of MEMA and the MDOT Emergency Management Coordinator. The criteria will be integrated into the ITS incident management system and will produce automated notification outputs with notification contact listings. The output information and notification list may be edited by the TMC Operators prior to the information being sent out electronically. Incident input and detection data will also be available to MEMA personnel through ITS workstations located in the MEMA operations center. The MDOT ITS will also notify other emergency response agencies, through local 911 centers. Other emergency responders and law enforcement authorities requiring notification will routinely be notified through their respective 911 centers by voice communications from TMC Operators. The MDOT ITS will provide the Operator with the appropriate 911 center contact information based upon geographic location of the incident as it is entered into the ITS. It will also be possible for the TMC Operator to forward the incident information to emergency responders through email generated by the ITS and sent to email addresses provided by the 911 centers and associated with those centers by the ITS incident database. This MDOT ITS concept also includes the notification of the Traffic Management services at the TMC or TOC by the Maintenance and Construction Management services of MDOT. This notification may be electronically through the ITS, by other electronic means or by voice communication with TMC personnel.

The MDOT concept for Early Warning System (EM07), as it pertains to the MDOT ITS, is depicted in Figure 6.16 below.

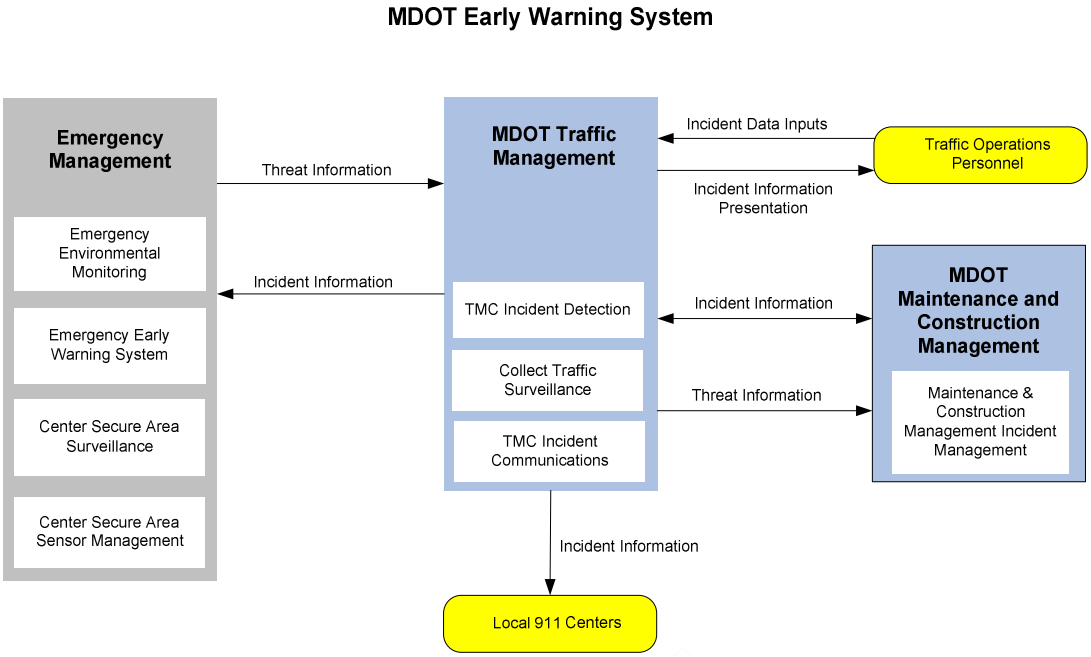


Figure 6.16 - MDOT Early Warning System Concept

6.1.15 Disaster Response and Recovery and Evacuation and Reentry Management (EM08 & EM09)

During disasters of all types, including disasters that require evacuations of the general public and the subsequent reentry to the disaster area, the role of the MDOT ITS is virtually identical in functional responsibility. Therefore, the Market Packages for Disaster Response and Recovery and Evacuation and Reentry Management, as they are defined in the National Architecture, can be combined to represent the MDOT ITS Concept of Operations. The following descriptions from the National Architecture are not presented in their entirety since much of their content is similar regarding the description of types of disasters, coordination of planning and response activities and other market packages that support these packages.

The following is a portion of the Disaster Response and Recovery Market Package (EM08) description from the National Architecture.

This market package enhances the ability of the surface transportation system to respond to and recover from disasters. It addresses the most severe incidents that require an extraordinary response from outside the local community. All types of disasters are addressed including natural disasters (hurricanes, earthquakes, floods, winter storms, tsunamis, etc.) and technological and man-made disasters (hazardous materials incidents, nuclear power plant accidents and national security emergencies such as nuclear, chemical, biological and radiological weapons attacks).

The market package supports coordination of emergency response plans, including general plans developed before a disaster as well as specific tactical plans with short time horizon that are developed as part of a disaster response. The market package provides enhanced access to the scene for response personnel and resources, provides better information about the transportation system in the vicinity of the disaster and maintains situation awareness regarding the disaster itself. In addition, this market package tracks and coordinates the transportation resources - the transportation professionals, equipment and materials - that constitute a portion of the disaster response.

The market package identifies the key points of integration between transportation systems and the public safety, emergency management and other allied organizations that form the overall disaster response. In this market package, the Emergency Management subsystem represents the federal, regional, state and local Emergency Operations Centers and the Incident Commands that are established to respond to the disaster. The interface between the Emergency Management Subsystem and the other center subsystems provides situation awareness and resource coordination among transportation and other allied response agencies. In its role, traffic management implements special traffic control strategies and detours and restrictions to effectively manage traffic in and around the disaster. Maintenance and construction provides damage assessment of road network facilities and manages service restoration. This market package builds on the basic traffic incident response service that is provided by ATMS08, the Traffic Incident Management market package. This market package addresses the additional complexities and coordination requirements that are associated with the most severe incidents that warrant an extraordinary response from outside the local jurisdictions and require special measures such as the activation of one or more emergency operations centers.

The following is a portion of the Evacuation and Reentry Management Market Package (EM09) description from the National Architecture.

This market package supports evacuation of the general public from a disaster area and manages subsequent reentry to the disaster area. This market package supports coordination of evacuation plans among the federal, state and local transportation, emergency and law enforcement agencies that may be involved in a large-scale evacuation. All affected jurisdictions (e.g., states and counties) at the evacuation origin, evacuation destination and along the evacuation route are informed of the plan. Information is shared with traffic management agencies to implement special traffic control strategies and to control evacuation traffic, including traffic on local streets and arterials as well as the major evacuation routes. Reversible lanes, shoulder use, closures, special signal control strategies and other special strategies may be implemented to maximize capacity along the evacuation routes.

Both of the Market Packages described above are supported by the MDOT Traffic Information Dissemination Market Package (ATMS06) and MDOT combination Market Package Wide Area Alerts (EM06) and Disaster Traveler Information

(EM10), which keep travelers and the public informed about transportation related information during both normal and disaster situations. These Market Package descriptions may be found earlier in this chapter.

During natural, technological or man-made disasters, MDOT is responsible for management, maintenance and when necessary, restoration of the surface transportation system. In this role many departments and offices within MDOT will be involved in disaster and evacuation planning, disaster response, evacuation implementation, reentry management and disaster recovery. The concept depicted in the diagram below (Figure 6.17) focuses on the role of the MDOT ITS as it relates to disaster response and evacuation planning, roadway network monitoring, information coordination between MDOT operational offices and departments, coordination of ITS resource response, dispatching of ITS resources such as Service Patrol assets and ITS Maintenance assets, traffic and traveler information dissemination and control strategy implementation utilizing ITS field equipment. During disaster situations MDOT ITS management will utilize the MDOT Emergency Management Coordinator as its primary point of coordination with federal and state agencies involved in the response and recovery efforts. The Mississippi Emergency Management Agency (MEMA) provides the overall management of these events utilizing the MDOT Emergency Management Coordinator as its liaison with MDOT. The Concept of Operations includes the placement of MDOT ITS operational work stations in the MEMA operations center for use during disasters or other events where the MEMA center is operational. Placement of these work stations allows for the coordination and monitoring of MDOT ITS operations by the MDOT Emergency Management Coordinator and MEMA personnel.

The MDOT ITS will coordinate disaster plans with MEMA and other response agencies and will enter the appropriate response plan data into the MDOT ITS for implementation by Operators when directed by MDOT Management. The response plans will include control data and traveler information that will be loaded to ITS field equipment based upon Operator inputs and geographic location information stored in the ITS database. The response plan will be presented to the Operators for verification and editing prior to implementation. All response plan data may be changed at any time by system operators with appropriate privileges. ITS field equipment may be included in multiple response plans and its response to control data inputs will be prioritized based upon response plan input data. Field equipment assets will be addressable individually or in designated groups. When a response plan has been implemented and is later modified, the system will present the Operators with information confirming the continued or discontinued utilization of all ITS field equipment that was being utilized prior to the proposed modifications. This presentation will allow the Operator to accept or reject the use of any of the field equipment in the proposed modifications. All field equipment that is no longer utilized in the modified response plan will revert to its normal state of operation.

The MDOT ITS will also track the status of the roadway network during disaster and evacuation scenarios and will provide graphic images and textual listings of major roadway facilities indicating their status. These images and textual listings will be compiled from the ITS geographic information database and status information added from field sensor data and/or Operator input data.

In the diagram below the MDOT Emergency Management subsystem represents the MDOT Emergency Management Coordinator assigned as the liaison with MEMA and other state and federal agencies.

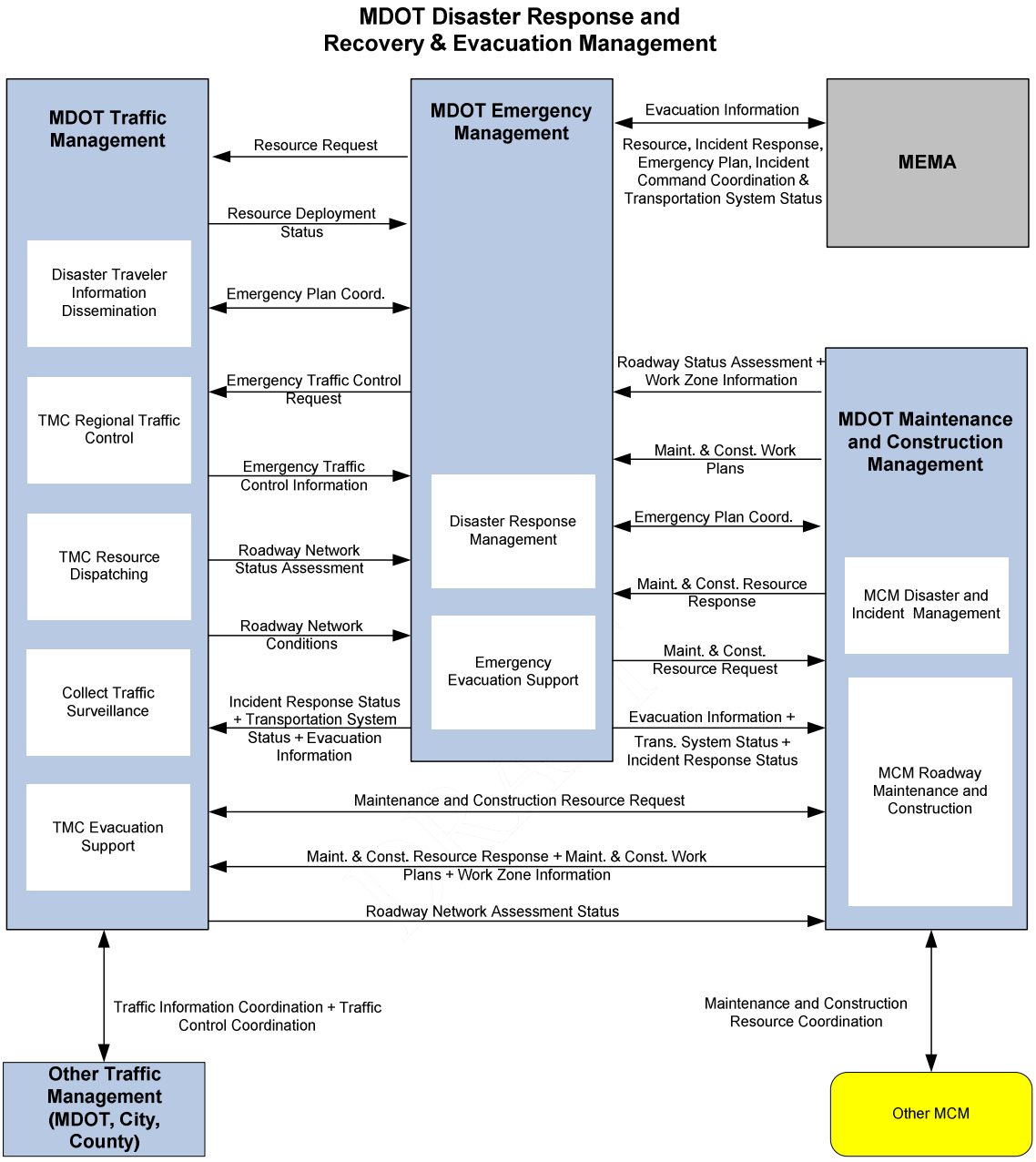


Figure 6.17 - Disaster and Evacuation Planning, Disaster Response, Evacuation Implementation, Reentry Management and Disaster Recovery Concept

6.1.16 Weather Information Processing and Distribution (MC04)

The following is the Weather Information Processing and Distribution (MC04) Market Package description from the National Architecture.

This market package processes and distributes the environmental information collected from the Road Weather Data Collection market package. This market package uses the environmental data to detect environmental hazards such as icy road conditions, high winds, dense fog, etc. so system operators and decision support systems can make decision on corrective actions to take. The continuing updates of road condition information and current temperatures can be used by system operators to more effectively deploy road maintenance resources, issue general traveler advisories, issue location specific warnings to drivers using the Traffic Information Dissemination market package and aid operators in scheduling work activity.

The MDOT ITS will collect roadway environmental data from roadway sensors and environmental monitoring sensors and will distribute that data through the Information Dissemination services of the ITS. The current concept includes the collection of the environmental sensor data by the Traffic Management service and specifically the TMC Environmental Monitoring market package. The concept also includes the monitoring of National Weather Service (NWS) information by TMC operators and the inclusion of that information in weather information distributed by the Traffic Information and Dissemination services. The current concept for MDOT does not include the involvement of direct data collection and processing by the MDOT Maintenance and Construction Management service, rather the utilization of the environmental information by Maintenance and Construction Management in their management activities and the dispatching of resources to respond as needed to environmental conditions such as fog, ice or flooding. At this time this concept does not involve the utilization of external Surface Transportation Weather Services to utilize or redistribute value-added weather information. The current concept does include the distribution of weather information, such as frozen or flooded roads, to Emergency Management (MEMA) since the ITS includes workstations located in the MEMA operations center. The MDOT ITS concept for Weather Information Processing and Distribution (MC04) is depicted in Figure 6.18 below.

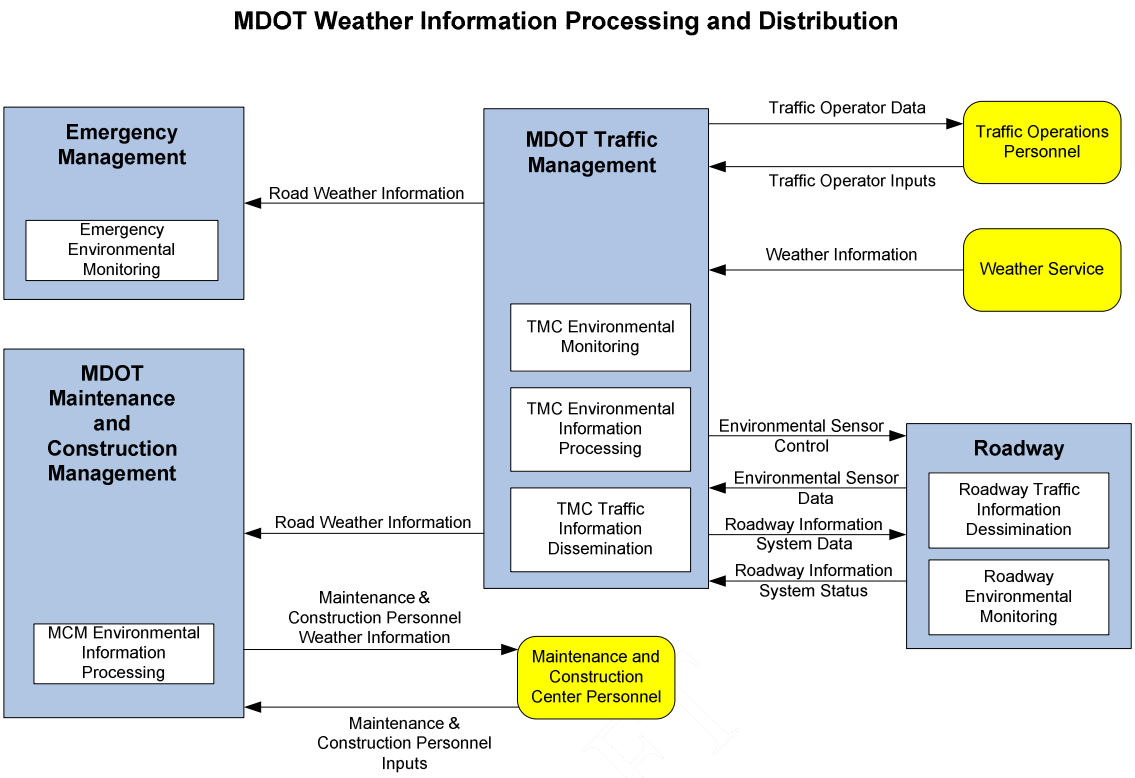


Figure 6.18 – MDOT Weather Information Processing and Distribution Concept

6.1.17 MDOT Roadway Maintenance and Construction (MC07)

The following is the Roadway Maintenance and Construction (MC07) Market Package description from the National Architecture.

This market package supports numerous services for scheduled and unscheduled maintenance and construction on a roadway system or right-of-way. Maintenance services would include landscape maintenance, hazard removal (roadway debris, dead animals), routine maintenance activities (roadway cleaning, grass cutting) and repair and maintenance of both ITS and non-ITS equipment on the roadway (e.g., signs, traffic controllers, traffic detectors, dynamic message signs, traffic signals, CCTV, etc.). Environmental conditions information is also received from various weather sources to aid in scheduling maintenance and construction activities.

Maintaining the roadway network that is in good repair and free of debris and hazards is the primary responsibility of MDOT and is represented by the Roadway

Maintenance and Construction subsystem. Additionally, this market package includes the maintenance of MDOT ITS field devices.

MDOT is responsible for determining where maintenance and construction activities are needed, when they will occur, what resources will be needed and what the impact will be on traffic. MDOT currently operates a web application, MSTraffic.com, which captures MDOT planned roadway maintenance and construction activities that impact travel along the roadway network. This information is made available to the public through the MDOT web site. This information will be integrated into the ITS and made available to other subsystems such as Traffic Management, Roadway Incident Management and MDOT Emergency Management. The information will also be made available to other external operators such as Transit Management, MEMA, ISPs and others as requested.

The portions of the Maintenance and Construction Management package pertaining to ITS field device maintenance will be addressed by the ITS by providing equipment status reports, deficiency reports, repair requests and repair status, as a minimum. The operational status of each roadway device will be obtained on a periodic basis to determine if the device or its communications link requires maintenance. When a device requires maintenance, it will be reported to the ITS Construction and Maintenance function. This reporting may be done automatically by the software or manually by a MDOT operator. MDOT ITS maintenance personnel will be notified of the needed repairs via work orders. ITS maintenance personnel will update the work orders as necessary and the operations personnel will be notified when the field equipment has been repaired and is operational.

The MDOT concept for MDOT Roadway Maintenance and Construction is shown in Figure 6.19.

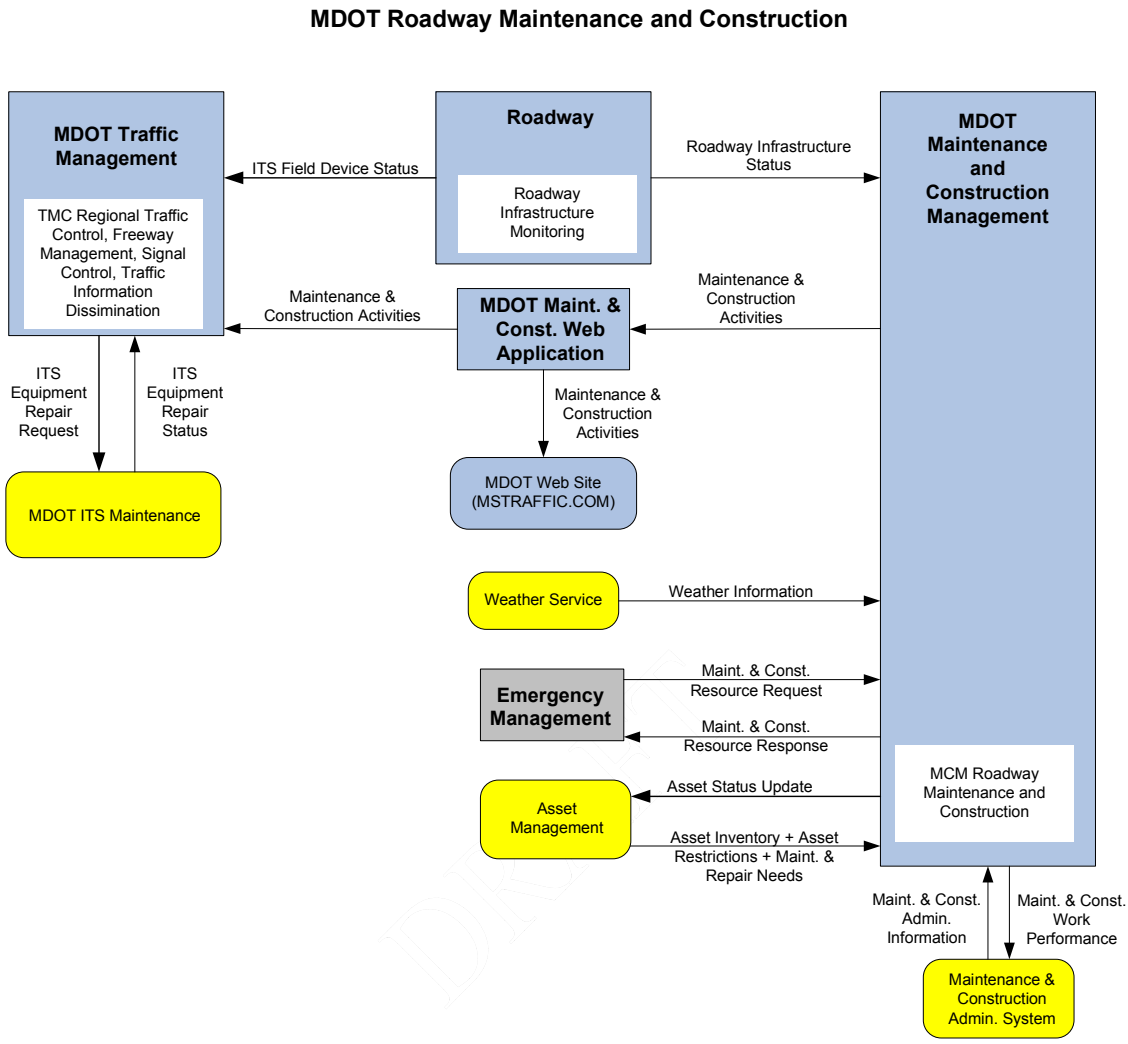


Figure 6.19 - MDOT Roadway Maintenance and Construction

6.1.18 MDOT Work Zone Management (MC08)

The following is the Roadway Maintenance and Construction (MC08) Market Package description from the National Architecture.

This market package directs activity in work zones, controlling traffic through portable dynamic message signs (DMS) and informing other groups of activity (e.g., ISP, traffic management, other maintenance and construction centers) for better coordination management. Work zone speeds and delays are provided to the motorist prior to the work zones.

Management of work zones, whether maintenance or construction, is primarily the responsibility of the MDOT Maintenance and Construction offices. However, the MDOT ITS Traffic Management service provides surveillance, monitoring, information coordination, device control and information dissemination to assist and improve work zone management and roadway network performance through these areas. Figure 6.20 below depicts the MDOT concept for work zone management as it relates to the MDOT ITS. In this concept the "Work Zone Traffic Control" equipment package within the Roadway subsystem represents only those devices that can be controlled by the MDOT ITS Traffic Management services. Those devices may include portable DMS, permanent DMS, roadway sensors, changeable speed limit signing or blank-out signing and video surveillance equipment. Static signing and other work zone static control devices are the responsibility of on-site maintenance and construction management personnel. Control of work zone ITS devices may be shared with the MDOT Maintenance and Construction Management function through manual control by on-site maintenance and construction personnel from the Project Engineer's office or electronically if maintenance and construction personnel have user access to the MDOT ITS.

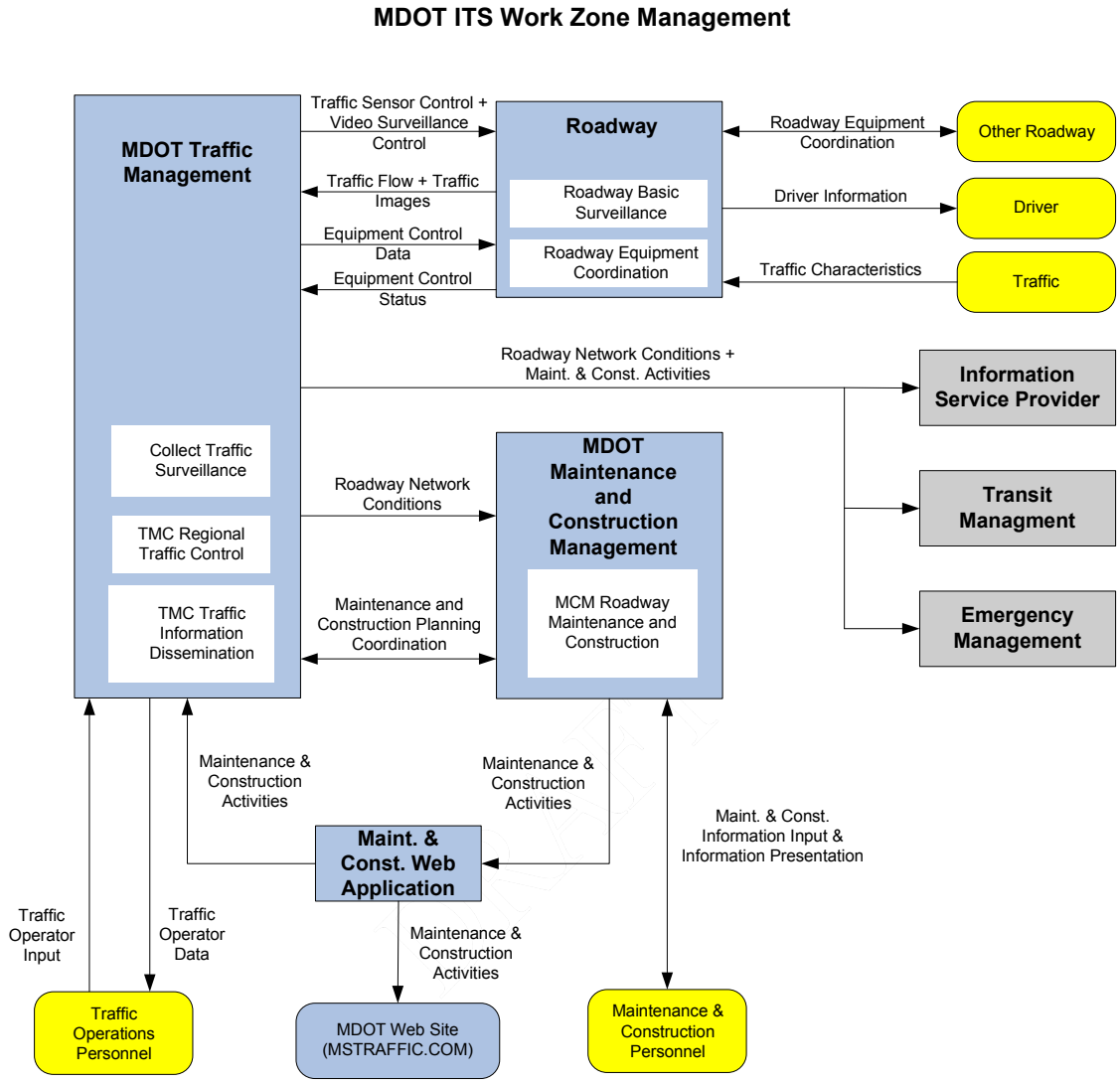


Figure 6.20 - MDOT for Work Zone Management Concept

6.1.19 MDOT Maintenance and Construction Activity (MC10)

The following is the Maintenance and Construction Activity (MC10) Market Package description from the National Architecture.

This market package supports the dissemination of maintenance and construction activity to centers that can utilize it as part of their operations, or to the Information Service Providers who can provide the information to travelers.

MDOT maintenance and construction activities information is distributed outside of the Department by the Maintenance and Construction Departments as well as by the Department Public Relations Office and other departmental management functions. The dissemination of construction and maintenance activity information that is a part of the MDOT ITS is the information that is distributed by the MDOT web site (MSTraffic.com) and that is gathered and redistributed by the Traffic Management services to both internal and external users. The primary redistribution of maintenance and construction activities from the ITS occurs through the Traffic Information Dissemination subsystem (see ATMS06). The concept of the distribution of MDOT maintenance and construction activities, as it pertains to the MDOT ITS, is shown in Figure 6.21 below.

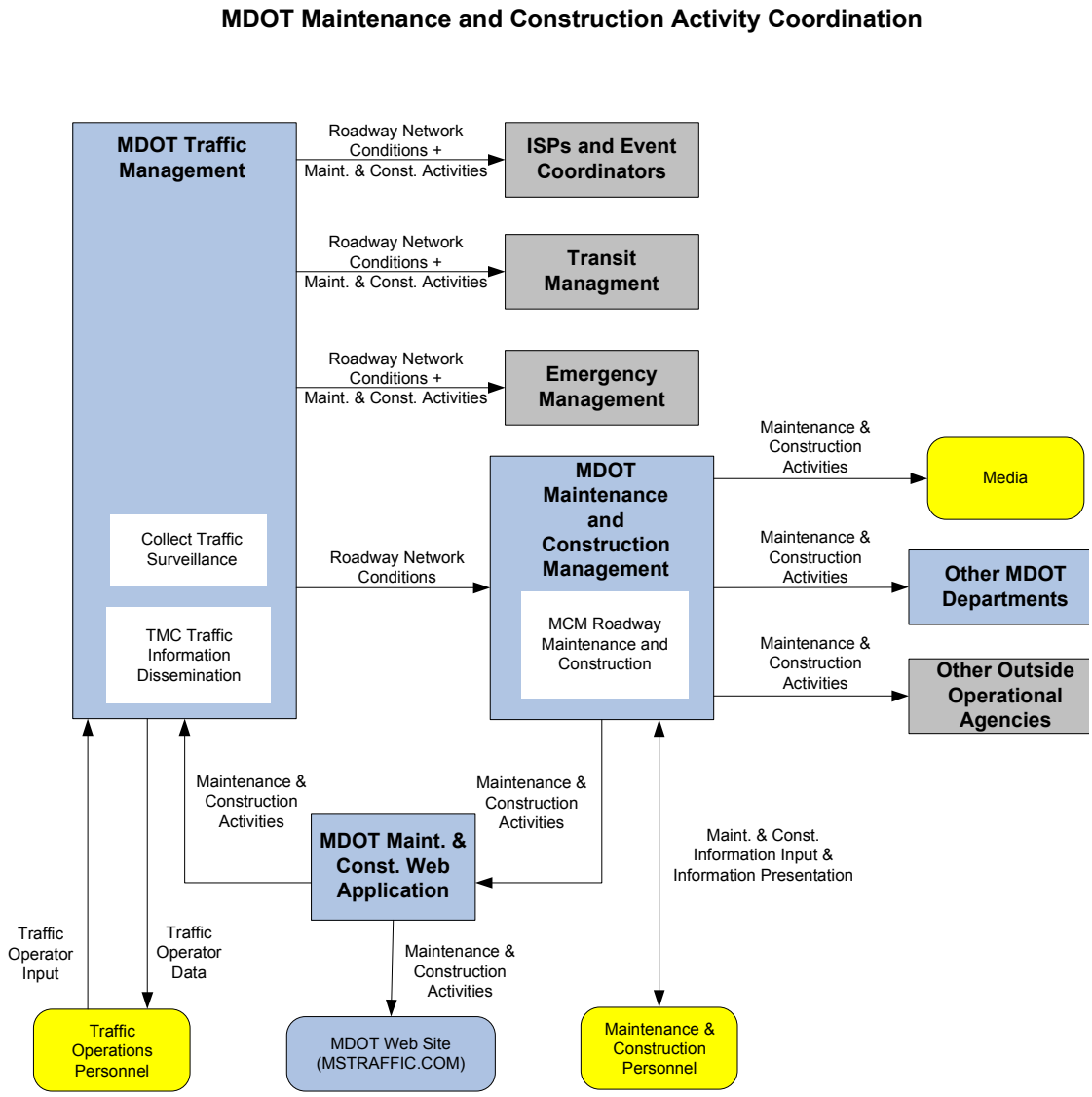


Figure 6.21 – MDOT Maintenance and Construction Activity Coordination Concept

7. Implementation, Operations and Support Environment

"Building on the ITS Architecture and Systems Engineering Management Plan, this Concept of Operations provides a high level description of the ITS system capabilities and the roles and responsibilities of MDOT."

This section contains a summary and review of the environment in which the system will operate. It also includes information regarding the resources and services the system needs to function. One section describes the implementation strategy that is to come out of this document's completion.

7.1 TMC Facilities

MDOT will initially operate a Statewide TMC from which freeway operations throughout the state and signal operations on regional state routes will be managed. This TMC will be configured to handle a staff of operators in a control center environment. The Concept for MDOT is to install three additional Regional TMCs across the state in the larger urbanized areas – Northwest Mississippi, Hattiesburg and the Gulf Coast. As more responsibility is transferred to Regional TMCs, the Statewide TMC will focus more on servicing the Jackson metro area while continuing to service the rural areas of the state not in the jurisdiction of a Regional TMC.

The Statewide TMC, which already has limited operations, is slated to become fully operational in the spring of 2008. Efforts are now underway to hire staff, develop standard operating procedures and implement training programs.

Several of the four Regional TMCs have already been slated to be located in a specific location and/or a specific building and room. These TMCs are in various stages of development and will become fully operational over the next several years depending on the level of ITS implementation in each region. More details on the TMC facilities can be found in Chapter 3 of this document.

7.2 ITS Software

In the short term, MDOT intends to continue utilizing the current ITS software platforms. This software platform includes 360 Surveillance for CCTV and vendor provided software for the DMS under construction. Additionally, other MDOT custom developed

applications are utilized for providing traveler information via the MSTraffic.com website. It is anticipated that this platform will be adequate for the next 1 – 3 years.

For the longer term, MDOT desires to implement a statewide integrated software package that will provide center-to-center communication for management and sharing of data and video. This software would be utilized in the Statewide and Regional TMCs and would be made available to local agencies which desire to be part of the Statewide ITS system.

Following the systems engineering process, the next logical step in developing a statewide ITS software package is the development of system requirements. Development of high level system requirements for future ITS software is slated to begin in early 2008 and continue throughout the remainder of the year. These system requirements will be based on information gathered during the Architecture development process and information contained in this Concept of Operations. Once these requirements are near completion, further assessment will be made as to the actual procurement process and schedule for the future ITS software.

7.3 Network Communications

Achieving a truly statewide, integrated ITS with center-to-center communications requires a robust network for distribution and management of video and data. The fiber ring located in the City of Jackson has been the first step towards building such a network. As the MDOT ITS system continues to grow, it is anticipated that additional ITS devices will be installed in the City of Jackson and elsewhere throughout the state. Communications systems will likely be a combination of fiber optic cable, leased lines and wireless communications.

As the system continues to grow and mature, it becomes important to plan for the future. Many ITS projects are planned and each project will have its own communications system in place. In order to facilitate a statewide, seamless communications system, plans must be put in place to establish communications standards and an overall plan for interconnectivity and interoperability. As such, MDOT will initiate a Statewide Communications Study in 2008. This study will evaluate the current communications system and consider future communications needs.

7.4 Other Implementation Strategies

As outlined in Chapter 2 of this document, the Concept of Operations is the third step in the systems engineering process. Building on the ITS Architecture and Systems Engineering Management Plan, this Concept of Operations provides a high level description of the ITS system capabilities and the roles and responsibilities of MDOT. The logical next step in the process is to refine the plan for future deployments of ITS needed to support the Concept of Operations.

During development of the Concept of Operations, strategies that support the implementation of the Concept were identified. These strategies should be considered for implementation in the future as the ITS system is implemented statewide over a period of time.

Strategy 1a: Develop Strategic Deployment Plan (SDP)

The purpose of the Strategic Deployment Plan is to define the strategy for implementing the MDOT ITS system. The SDP should focus on physical deployment of the system. At a minimum, the SDP should:

Establish ITS Geographic Expansion Guidelines

Building on the Systems Engineering Management Plan, the SDP should establish guidelines for physical deployment of ITS statewide by MDOT. These guidelines should set "warrants" for when ITS will be included in planned roadway, bridge and maintenance projects or as standalone ITS projects. The guidelines should address the deployment of field devices, incident management strategies (Roadway Service Responders/Incident Management Teams), etc. Guidelines should also be developed for the conceptual approaches to implementing ITS including the types of devices to be deployed, device spacing, communications requirements, etc. These guidelines will ensure that future ITS implementations are scalable, cost effective and appropriate to the projects being considered.

Develop ITS Capital Projects

Using the MDOT Systems Engineering Management Plan and the guidelines developed above, examine opportunities to integrate ITS into projects already programmed by MDOT. Major arterial and interstate reconstruction projects, and other projects which will cause prolonged disruption to traffic flow, are likely candidates for ITS strategies.

These same guidelines should also be used to evaluate the state route system to determine where and when ITS expansion should occur if other projects are not planned. The SDP should identify and prioritize future ITS needs and recommend capital projects to fund ITS implementation.

Specifically, a menu of logical projects, to deploy ITS field devices for the geographic areas identified in the Deployment Plan, should be provided for construction activities that will be done by the Districts for a period of 5 -10 years.

Strategy 1b: Develop ITS Business Plan (IBP)

The ITS Business Plan is a roadmap of how MDOT will deploy the ITS projects described in the Strategic Deployment Plan. The IBP will identify the programming of projects and policy initiatives and describes the purpose, requirements, responsibilities, estimated cost, and implementation schedule for each project initiative. The IBP will be

developed concurrently with the SDP because of the synergy that is gained by developing these documents in tandem.

Strategy 2: Integrate District Offices into the MDOT ITS Program

The District Offices over time should play an increasing but integral role in planning, deployment, operations and maintenance of ITS in MDOT. District Offices are responsible for activities which support ITS including:

- Roadway, bridge and maintenance project planning and design
- Installation, operations and maintenance of traffic signals and other ITS devices
- Construction project management
- Reporting of lane closures due to construction and maintenance
- Primary point of contact for local agencies

MDOT may want to consider in the future establishing an ITS program in each District Office to provide planning and managing ITS activities. This could begin with the establishment of an "ITS Liaison" in each District Office. The ITS Liaison would serve as the ITS champion in the District Office and would ensure that ITS is appropriately considered in District Office activities. Duties could include:

- Responsibility for leading the planning, deployment and implementation of ITS in the District
- Educating District personnel on the current activities in ITS
- Serving as point of contact for local government agencies for ITS related activities
- Serving as point of contact for coordination of 511 in the future, Traffic Incident Management (TIM) teams, and other statewide ITS activities

Strategy 3: Engage the Local Agencies

The local government agencies are important partners with MDOT in the implementation of ITS. These agencies are users of the MDOT ITS system and play an integral role in its success.

MDOT should initiate a focused effort on involving the local agencies in the future decisions regarding the direction of the MDOT ITS system. This may be accomplished by meeting with the local agencies as a follow-up to development of the Concept of Operations to educate them on future plans for the MDOT ITS system. MDOT should

also consider establishing user groups that share knowledge of their ITS issues, resolutions, operation successes, etc…

Strategy 4: Traveler Information Systems

This document recognizes the importance of traveler information systems, specifically 511, in the future. MDOT is one of the few remaining states that does not have concrete plans for implementing 511. Future 511 implementation is inevitable and MDOT should begin planning in the near future.

To implement a successful 511 system, MDOT must be in a position to obtain timely and accurate information on road conditions. This is especially true for limited access roadways, construction and maintenance work zones, major incidents and special events having a significant impact on traffic. As future projects and other system expansions are considered, special emphasis must be placed on collection of roadway conditions to support the future 511.

8. Operational Scenarios

"These operational scenarios tell stories given a variety of circumstances ranging from normal operations to stress and failure conditions."

This section of the Concept of Operations is written to assist readers and the future developers and operators of the MDOT ITS by explaining how the system can be used to manage incidents and other traffic-related situations that occur on the transportation system. During the development and further refinement of the Mississippi Statewide ITS Architecture, multiple services were identified for inclusion in the total MDOT ITS. During the development of this Concept of Operations it was determined that six service areas would be included in the Concept at this time. These services include:

- Traveler Information
- Traffic Control
- Incident Management
- Service Patrol Management
- Wide Area Alerts
- Disaster and Evacuation Management and Response Coordination

The following scenarios do not address all of these service areas but demonstrate the methodology for scenario development that may be utilized in future efforts to define the MDOT ITS user activities and system interactions under varying conditions and circumstances.

8.1 Scenario 1. Incident Management

In this scenario, there was a major incident on the freeway which affected both the freeway and arterial system. The scenario describes how ITS, implemented by both MDOT and the local governments, would be used to manage the incident and provide traveler information. The focus is on the multi-agency approach to Incident Management.

On a late Thursday afternoon in July, an eastbound SUV on Interstate 20 at S. Pearson Rd. swerved to the right to avoid a collision with a motorcycle and glanced off of the bridge railing over Southbound S. Pearson Rd. A trailing compact sedan hit the car ahead of them at an impact speed of 50 MPH and scattered debris over eastbound lanes of I-20 and down onto S. Pearson Rd. A southbound mid-size sedan on S. Pearson Rd was forced to brake to avoid the debris and was rear-ended by a service vehicle from a pest extermination company. Debris from both crashes now lay across S. Pearson Rd. As a result, southbound direction of S. Pearson Rd. and both eastbound lanes of I-20 were impassable.

Multiple witnesses called 911 and reached the Rankin County Dispatch Center. First responders (county and state police, fire and rescue, EMS) were alerted and dispatched to the scene. The Statewide TMC noted a sudden drop in the average speed on I-20 near mile marker 47 and then received a confirmation from the 911 center about the incident. The roadway service patrol unit was dispatched to the scene to assist in traffic control and debris pick-up. The TMC operator moved the I-20 cameras west and east of S. Pearson Rd. to view the accident scene and posted an alert message on the DMS devices located on I-20 and I-55. The accident and lane closure information for I-20 was posted to the MSTraffic.com web site and 511.

On the scene (black box on Figure 8-1), responders began to attend to the injured. The City of Pearl Fire Department doused the wrecked vehicles to prevent fire and one woman had to be removed from her vehicle using the Jaws of Life. Roadway service unit operators and the Mississippi Highway Patrol worked together to re-route northbound I-20 traffic onto the off-ramp of S. Pearson Rd. and back onto the on-ramp for I-20 east. (red route on Figure 8-1). Traffic was completely stopped whenever an emergency vehicle needed to access or depart the scene. City of Pearl Police worked to manage a local detour for southbound S. Pearson Rd traveling west on Riverwind Dr and south on Childre Road and take White St then Murray Dr. to merge onto S. Pearson Rd. They retimed the nearby traffic signals to help move traffic through the detour area.

A driver heading eastbound towards the airport on I-20 saw the DMS update with an alert about the accident ahead. A passenger in the car called 511 to check on the expected travel times. After learning the travel time would be 90 minutes, the driver decided to take Exit 47 to detour over to U.S. 80 and use that route to get to the airport.

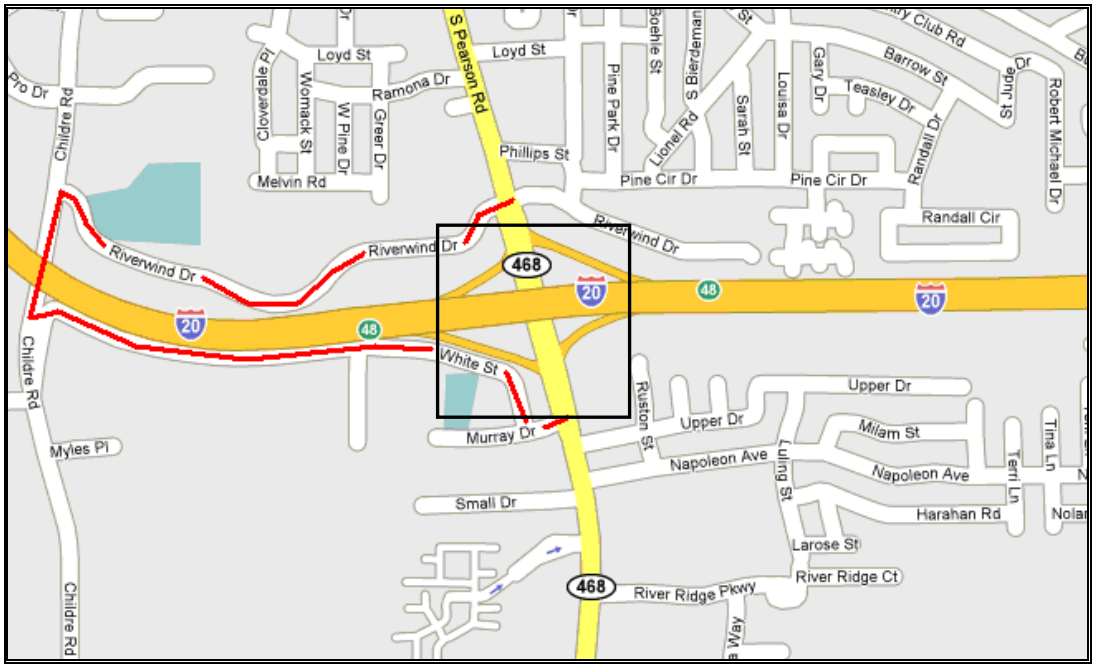


Figure 8-1 – Scenario 1.

Once all the injured were removed from the scene and taken to Mississippi Baptist Medical Center in Jackson, wrecker services began to tow the vehicles and the roadway service unit worked to clean-up the excess debris. Ten gallons of pesticide spilled on S. Pearson Rd and the roadway service operator had to execute the hazardous waste removal procedure. As a precaution, the City of Pearl Fire Department's HazMat Response Team came to the scene to assist in the cleanup.

After 90 minutes, all vehicles, debris, chemicals and injured were removed from the scene, the roadway service unit and police units began to allow traffic to flow on both S S. Pearson Rd and I-20. The Statewide TMC was notified and the road closure designations were removed and all signal timings are reset to the pre-incident settings. MSTraffic.com and 511 were updated to remove the accident information and the DMS was returned to a normal travel time display.

8.2 Scenario 2. Major Snow and Ice Storm

In this scenario, there was a major snow and ice storm that was affecting northern Mississippi and the cities of Hernando and Southaven that lie south of the border with Tennessee. In addition to describing how ITS was used to manage the event, the scenario also discusses the strategy of coordinating the response with the Tennessee DOT (TDOT).

On a Saturday morning in December, the National Weather Service (NWS) office in Memphis issued a heavy snow and ice storm warning, for a storm which was traveling northeast from Arkansas into the Memphis area and northern part of Mississippi. The MDOT Northwest TMC Supervisor currently on duty, was notified of the severe weather conditions. He assigned an operator to monitor the freeways and bridges specifically. MDOT also alerted the emergency responders in the warning area to be on standby. Mississippi Emergency Management Agency (MEMA), who responds to emergencies through the State Emergency Operations Center, was also notified of the severe weather conditions. [Depending on the severity of the weather and the imminent threat to the road conditions, different agencies respond to emergency situations.]

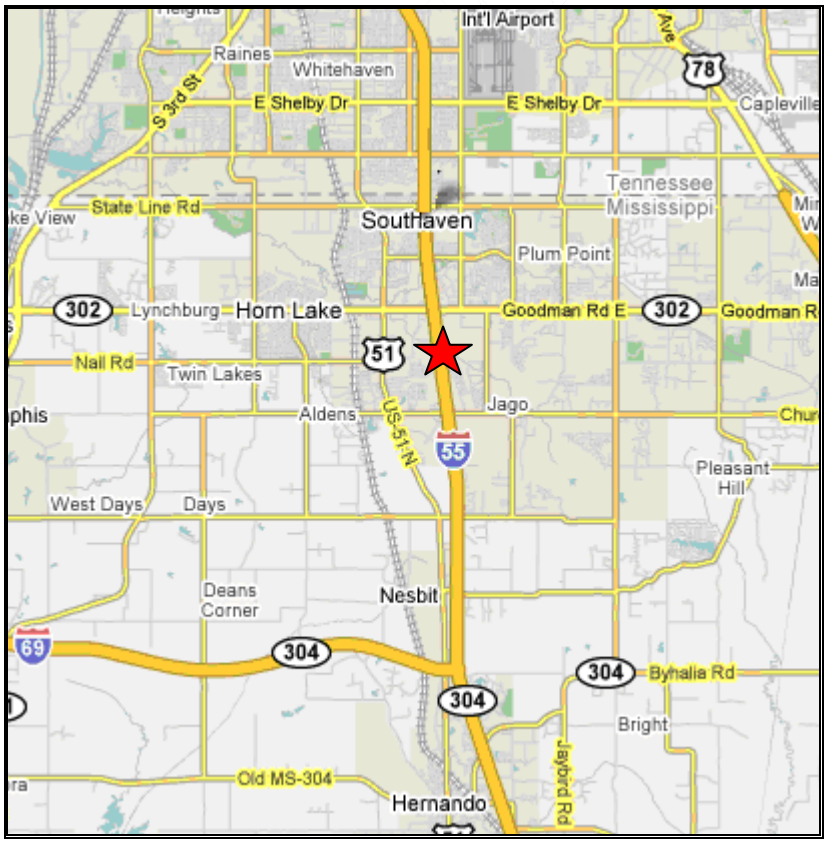


Figure 8-2 – Scenario 2.

TMC operators used real time traffic webpage MSTraffic.com to monitor freeway traffic using CCTV cameras and the cell phone tracking subsystem. They used RWIS sensors to monitor pavement freezing conditions along I-55 from south of Southaven to Memphis. The operator displayed forecast warnings on DMS units about the snow and ice storm conditions for the evening. MDOT Northwest TMC immediately notified any affected local TOCs about the imminent danger. The tow trucks and the de-icing trucks in the area were notified to be on standby to address potential incidents and ice build-up. Two roadway service units from the Northwest TMC were dispatched to the warning area in case they were needed.

Subscribers to statewide road alerts sponsored by MSTraffic.com were sent email alerts and text messages in the impacted region alerting subscribers of the impending danger so unnecessary trips could be delayed. Radio and TV stations in the regions were sent traffic/weather advisories for local broadcast and the alert was posted on the 511 traffic information system [511 is a planned future telephone traffic information system in Mississippi – it currently exists in Tennessee] for that region in Mississippi.

By 3:00 PM snow and ice hit DeSoto County affecting traffic on I-55 between Hernando and Southaven traveling into City of Memphis, making the roads in the area nearly impassable. Trucks and passenger vehicles were stranded on the freeway at mile marker 287 (red star in Figure 8-2) due to an overturned eighteen-wheeler. One motorist called the 911 center in the City of Southaven to notify officials about the incident. The 911 center dispatched ambulance and paramedic services from Southaven and DeSoto County. MDOT received notification from the police about the crash and displayed accident information on the DMS signs. MDOT then notified TDOT of the incident which necessitated the Memphis TMC adding the appropriate messages on DMS units in Memphis along southbound I-55. MDOT also updated the 511 and MSTraffic.com traveler information systems about the accident and provided traffic information on the affected roadways. TDOT made similar updates on its systems. MDOT and TDOT also dispatched tow trucks and de-icing trucks that were on standby earlier. An existing MOA was available to enable MDOT and TDOT to have cross-jurisdictional rights to best service the issues created by the winter storm. The paramedic services attended to the driver, and then the incident was cleared from the road.

8.3 Scenario 3. Arterial Management: Signal Failure and Timing Updates

In this scenario, it is a typical Monday morning in the Jackson metro area. A TMC Operator arrives in the TMC and begins his work day at the main operator console, adjusts the console monitors, keyboard height, and logs into the system to begin his daily routine. Using the systems at his disposal he:

- Views surveillance video of both surface streets and freeways using City and MDOT cameras to determine if any major traffic problems exist.
- Uses the MDOT ITS system to determine if there are any reported incidents or problems on the roadways.
- Selects video feeds to be displayed on the display wall and his various monitors.
- Reviews all connected traffic signals to verify that they are on-line and in proper operation.

The TMC Operator is notified that a citizen has complained about the operation of the traffic signal at U.S Route 80 and Terry Rd. (red star in Figure 8-3) specifically, the citizen has complained that westbound traffic is not getting a left turn signal. Traffic is heavy due to classes at nearby Jackson State University as well as normal commuting. The operator selects the surveillance camera near the intersection and puts the video image on one of his monitors. On a separate monitor, he brings up the data from the traffic signal controller at the intersection. Using the real-time video images in concert with the controller data, he realizes that the citizen is correct – westbound vehicles are not being recognized by the vehicle detectors at the intersection. He checks ACTRA and the CCTV camera for any failure information and attempts to remotely fix the problem. Unsuccessful, the operator prepares a maintenance ticket and uses the city radio at his console to call the supervisor of the County's Traffic Signal Technicians. He relates the information regarding the signal to the supervisor, who then dispatches a signal technician to the intersection to correct the problem.

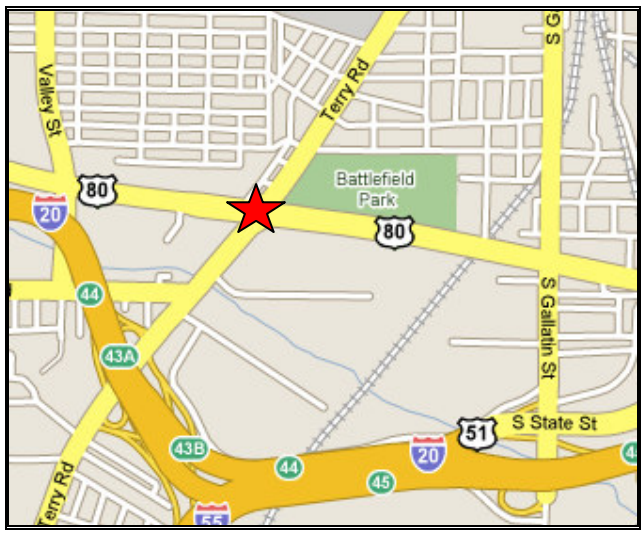


Figure 8-3 – Scenario 3

Throughout the rest of the morning, using the systems available, the TMC staff checks the operation of many of the roadways and signals in the area. They can also verify operational complaints and in many cases, resolve the problem without sending crews to the scene. By verifying the complaints, crew time is not wasted driving to a signal just to determine that no problem actually exists.

One of MDOT's traffic signal engineers had been working the entire month developing new signal timing plans for Lakeland Dr (MS 25) between I-55 and Airport Rd. This area is often congested in the vicinity of River Oaks Hospital, Smith-Wills stadium, the Mississippi Sports Museum and the Mississippi Agricultural and Forestry museum gets a lot of special event traffic from Millsaps and Belhaven Colleges as well as Memorial Stadium. During the month he has collected hours of video data of traffic on the route using the video recording software in the TMC computers. Viewed at a high speed playback, he is able to view traffic patterns over several hours in as little as a few minutes. This information has helped him in setting up his timing plans. Supported by field crews, the signal engineer uses the ACTRA™ workstations in the work area at the rear of the TMC to download the new timing plans to the controllers in the field. Once the timing plans are downloaded and verified as operational, the field crews are dispatched to other tasks. The signal engineer then spends the next few hours observing traffic along the route using the surveillance cameras and connects to the individual traffic signals as necessary to make small adjustments in the timing plans.

Appendix A – Short Term Staffing Plan

1. INTRODUCTION

The original document: MDOT ITS Program Proposed Short Term Staffing Plan and Organizational Structure was Prepared by Gresham, Smith and Partners, MS, P.C. in March 2007. A copy has been included with the Concept of Operations as a reference document.

This proposed short term MDOT Intelligent Transportation System (ITS) staffing plan and organizational structure addresses both the immediate and short term areas of need, skill sets and appropriate levels of personnel for the ITS program.

The goal is to develop staffing levels, skill sets, and organizational structure that meet the immediate needs of the current and short term operations and responsibilities of the ITS program. This proposed short term staffing plan and organizational structure is part of a larger ITS Staffing Plan task that will be updated once the Concept of Operations and Needs Analysis tasks are completed. The ITS Staffing Plan will eventually include mid-range and long-term operations and a migration plan from the short term to the long range operations.

This ITS Staffing Plan will look into the Traffic Engineering organizational structure and make recommendations on ways to improve that structure through reorganization and reporting relationships (within Traffic Engineering) including recommendations on additional staff, both as DOT staff as well the use of contractual or maintenance services where applicable. The Plan will provide an organizational structure of the staff, the skill sets needed for each identified position and areas of responsibility for each identified staff position. This evaluation will include how the coordination between the ITS staff and other departments within MDOT (IT, public information, maintenance, etc.) should occur.

The scope of work in developing this proposed staffing plan and organizational structure included an evaluation of current staff involved in all ITS activities and their roles and responsibilities. The current staff's skill sets were compared and analyzed against the current operational requirements of the system and expected high level operational concepts that are currently in development.

As the ITS program grows and develops, the future expectations for operating and maintaining the system will grow as well. This includes the coordination efforts with not only other DOT departments but other outside agencies, emergency responders, and the public. Achieving the required staffing levels to successfully implement, operate and maintain the system will ensure that the department meets its stated mission to "use ITS technologies to improve the quality of life for State residents and visitors by providing more reliable, informative, safer, and flexible passenger and freight multi-modal transportation services."

As previous studies and lessons learned have shown, once TMCs are operational, the operating agency finds both agency and public expectations for their assistance build rapidly. In that context, operational procedures need to be developed to operate and maintain the ITS, to be conducive to modification and to change as the systems evolves and matures.

2. GENERAL FINDINGS AND RECOMENDATIONS

The analyzation and evaluation of the current ITS organizational structure found that for the current ITS systems and responsibilities the current staff was already overloaded. This did not take into account the current projects and activities under development or construction that will expand the ITS components throughout the state and increase the coordination with more departments and agencies. The addition of Dynamic Message Signs (DMS) will also result in higher levels of expectations from the public for current and new additional services.

The main issue is that the staff level is so small, that all efforts are geared toward work than can be accomplished with the limited staff, as opposed to meeting specific performance measures needed for the system. If one staff member is out, then much of the work will be delayed until they return because others are too busy completing work they are already doing, have little knowledge of the specifics of the work being done by the staff member that is out, or what stage they were at with the work.

As the public and other departments and agencies become more reliant on the ITS department, ITS systems must also become more reliant. DMS, being just one example, will be expected to have accurate information, and the public will always be watching. The addition of DMS alone will require that there be TMC operators to put accurate and timely information on them.

The recommendations in this report are based on providing these services to the public with an acceptable level of reliability. The recommended short-term staffing levels include the personnel needed to operate and maintain the system at an appropriate level. As shown on the organization chart on the following page, it is recommended that the TMC operations initially include a TMC Manager/Senior Operator and a small staff of operators to provide basic operations from 6am till 8PM Monday through Friday. For maintenance of the system, it is recommended to have 3 ITS Maintenance Specialists (current employees) that manage three regions separately in order to provide better response times and better regional knowledge. The Maintenance Specialists would not be able to complete all the required maintenance activities themselves; therefore they would be responsible for managing maintenance contracts in each of their respective regions. A Network Specialist position is recommended to to manage ITS network and computer systems issues and to also work closely with IT Staff on behalf of the ITS department. It is also recommended that a Registered Engineer be part of the ITS staff to assist the existing ITS Program Manager with many of the management and review activities required for the program.

Please see Appendix A for position descriptions for each of the proposed positions.

3. ITS OPERATIONS

The general objective of TMC operations will be to enhance safety, services, and timely and accurate traffic flow information for MDOT patrons. As ITS elements expand and new components and systems are added, responsibilities and needs of the ITS to provide expanded and more responsive services to both internal and external customers will also increase. TMC functions will include incident management, emergency management operations, special events management, traveler information dissemination, and associated notifications and reporting. These functions will be performed using ITS application software, ITS hardware components, and applicable operational checklists and procedures.

TMC operations will use the collection and dissemination of information and traffic data to:

- Enhanced safety, services, and traffic flow for MDOT patrons
- Early detection and management of traffic crashes/incidents
- Better dissemination of traffic information to patrons, e.g., construction/maintenance closures, special events, etc., allowing motorists to make more informed travel decisions
- Enhanced coordination between MDOT agencies and other Districts
- Evacuations and other emergencies

While the TMCs will act as the nerve centers of the ITS, the day-to-day operations of the system will also include information input directly into the system by other DOT offices (PIO, Construction, Roadway Maintenance, etc.) the HIGHWAY PATROL, local city agencies, and private information service providers (ISP).

With an ITS project underway to provide 9 DMS, it will be important to have TMC operations and TMC operators in place that can appropriately utilize to DMS. It will be important that those operators be trained to use the entire ITS system available to them and follow the proper procedures. Those procedures and training methods have to be developed prior to the initial operations of the system. It will be important to get the appropriate person early to fill the recommended TMC Manager/Senior Operator position so they can begin working with other ITS staff, departments, agencies, and TMCs to develop those procedures and methods prior to DMS operations.

This plan recommends that the TMC Manager/Senior Operator be staffed approximately 3 to 6 months before the beginning of DMS operations in order to begin development of some basic operational procedures and departmental coordination policies. It is also recommended that the TMC operators be staffed approximately one month before DMS operations so they can be adequately trained on the system tools that will be available to them, the operational procedures, and coordination efforts they will be responsible for
.

It is recommended that the TMC operations be provided via a service contract. This will make it easier for the department to request staff adjustments, such as expanding staff to cover additional operating hours as needed. Staff available through contracted services also puts the burden of higher turnover on the contractor for those lower level positions such as operators, especially part time personnel. As shown in the organizational chart, the following operations positions are recommended.

- TMC Manager/Senior Operator (1) – Reports to the ITS Engineer and indirectly to the ITS Program Manager. Supervises and manages the TMC staff. Maintains and revises TMC operation procedures. Coordinates with other DOT agencies and departments, Traveler Information Services, other District TMCs, the Highway Patrol, and other local public agencies. Operates the ATMS software along with voice, radio, data, and video display subsystems. Ensures operations are conducted within the design parameters, user's guide, operational procedures, checklists, and policies. Responsible for both creating and assigning reports to other operators. Coordinates incident and event information to other departments and agencies according to procedures

- TMC Operators (2 plus part time support) – Report to the TMC Manager/Senior Operator. Monitors traffic operations. Operates the TMC ATMS software using the operational procedures and checklists contained within the system. Notify higher level management of major incidents and emergencies. Monitor and operate system field devices to include DMS, CCTV, HAR, detection subsystems, RWIS, PWZSS, AVI, and drone radar.

4. ITS MAINTENANCE

The Department is in the process of deploying an Intelligent Transportation System (ITS), which includes voice, data, and video subsystems, communications infrastructure, and field devices. The communications infrastructure will be a combination of cellular service, fiber optic network, microwave transmission and leased telephone lines to provide the links between Traffic Management Centers (TMCs) facilities, field devices and other traffic management and public safety agencies. Field devices include or will eventually include Dynamic Message Signs (DMS), Closed Circuit Television (CCTV) cameras, Highway Advisory Radios (HAR), and Vehicle Detection Stations (VDS) radar to provide speed, volume and occupancy data.

With the beginning of TMC operations, it will be the responsibility of ITS Maintenance to keep the ITS field devices, communications systems, and other ITS components operating reliably.

ITS Maintenance will be responsible to perform preventative maintenance, provide inventory of system and sub system components, keep up with support and warranty information, provide technical troubleshooting and analysis of problems reported by Network Administration or TMC staff. The ITS Maintenance will also be responsible for

ensuring configuration of ITS systems meet the configuration as documented and as directed by the ITS Engineer.

Maintenance Concept
The ITS Maintenance will be broken into three regions. The North Region will include South Haven, Tunica, and Oxford. The Central Region will include all the Jackson greater metro area and Vicksburg. The South Region will be inclusive of the Gulf Coast areas and Hattiesburg.

There are several factors behind having ITS Maintenance broken into three regions. One is that with different regions come different regional issues. That is recognized already by having three ITS Regional Architectures. As there are different Regional Architectures, different levels of ITS deployment and different ITS components may be utilized from one region to another.

Another concept is that the level of response needed for maintenance leads to the recommendation that services for ITS Maintenance be contracted. Using contracted services for ITS maintenance will ensure appropriate levels of staff and expertise to respond effectively in an appropriate amount of time.

With the growth of ITS and the beginning of TMC operations, there will be more components to maintain, troubleshoot, and fix. With more public dissemination and interagency coordination, the importance of a reliable system is critical to the credibility of ITS and Traffic Operations. This means response times for checking, troubleshooting, and fixing problems as quickly as possible will be one of the greatest priorities of ITS Maintenance. As an example, the public will be expecting to receive incident information on a DMS once they become operational, and will not expect them to be down long for maintenance. A similar example and even of greater concern will be when incident information may be on a DMS and systems fail to communicate allowing a DMS to be "blanked" after an incident

Since there will be three regions it is recommended that there be three separate ITS Maintenance contracts, one for each region. This will allow for each contract to cover the specifics of the region and can be bid appropriately. It also will allow for more competition and regional expertise. This would not exclude one contractor from maintaining multiple regions as long as they could best provide the minimum coverage for each region. Having three separate contracts will ensure desired level of staff, response times, and resources for each region. Regional contracts as opposed to one single contract would also help ensure that a major incident in one region does not draw important resources from the others.

Maintenance Administration
This proposed short term ITS organizational structure recommends having 3 ITS Maintenance Specialist, one for each region as DOT staff. Each ITS Maintenance Specialist will serve in an on call capacity to problems and trouble tickets for the region they are responsible for. They will serve as a first responder to any reported problem with

the system as described in the ITS Maintenance section. The staff should be educated and skilled in the areas necessary to perform general trouble shooting and configuration of the equipment and system, or be trained to do so. As a primary responder to the problem, they will be responsible to evaluate if they can handle the issue themselves or if they should contact the ITS Maintenance contractor for the region to respond to the problem. The ITS Maintenance Specialist then will verify the work and the quality of the work done by the ITS Maintenance contractor. The ITS Maintenance Specialist will record specifics of the work done such as, the responders, time arrived, time completed, and other information relative to the problem.

The ITS Maintenance Manager shall make sure that the work done by the ITS Specialists and corresponding ITS Maintenance contractors provide as much uniform service as possible with the exceptions of regional differences. The ITS Maintenance Manager shall also deal with contract issues and verify that ITS Maintenance Contractor invoices are accurate and are backed up by the ITS Maintenance Specialist documented trouble ticket reports. The ITS Maintenance Manager is also responsible for making sure ITS Maintenance contractors are meeting their minimum performance measures, such as response times.

- ITS Maintenance Manager (1) – Reports to the ITS Engineer. Troubleshoots, fault isolate, and repairs system equipment. Maintain and administer warranty and contract maintenance agreements. Operate maintenance software tools to document maintenance activities.
- ITS Maintenance Specialist (3) – Reports to the ITS Maintenance Manager. Troubleshoots, fault isolate, and repairs system equipment. Maintain and administer warranty and contract maintenance agreements. Operate maintenance software tools to document maintenance activities.

5. ITS NETWORK ADMINISTRATION

ITS Network Administration will be the responsibility of the ITS Network Specialist and will serve in a very similar way as the ITS Maintenance section. The difference is that the ITS Network Specialist will be responsible for the computer systems, workstations, and network components in the TMC. The ITS Network Specialist will also be responsible for network configurations of field switches and will at times work directly with ITS Maintenance staff on network related problems with field switches or other network related field components.

The ITS Network Specialist will report directly to the ITS Engineer and be responsible to implement any TMC or network configuration as directed by the ITS Engineer or documented by the Configuration Management Board (CMB). The CMB does not currently exist but will be formed prior to the beginning of operations.

The ITS Network Specialist will be responsible for documenting, collecting documentation, updating documentation, and reporting and disseminating documentation to appropriate personnel for TMC system components and network. The Network

Specialist will also be a first responder to trouble tickets and calls for TMC computer systems, workstation, and WEB pages.

Currently, the ITS department relies upon IT staff for the configuration of network devices and subsystems as well as WEB site development and content. The ITS Network Specialist will be responsible to be the designated contact and ITS department representative to the IT staff for any work done by IT staff on ITS or TMC systems, networks, or WEB pages. The ITS Network Specialist will verify that work done by the IT staff meets with the overall system configuration and guidelines as specified by Intelligent Transportation System documents and the ITS Engineer. Other contractors or vendors (BellSouth, Temple, etc.) that provide service, support, or warranties on TMC System computers and components on behalf of ITS for any work needed of them such as network or WEB related issues will also be managed by the ITS Network Specialist.

- ITS Network Specialist (1) – Reports to the ITS Engineer. Manages overall maintenance of the TMC system software and network. Responds and documents trouble reports/tickets for TMC computer systems and workstations. Creates and collects ITS and TMC computer System and network configurations. Manages ITS and TMC computer and network system contract, support, and warranty vendors and contractors.

6. ITS MANAGEMENT AND ENGINEERING

As ITS systems expand and TMC operations begin it will be important to have the appropriate level expertise and leadership on the group. The first level of leadership and management will be the ITS Program Manager. This position will be responsible for setting the goals and priorities for the ITS section and align them with the goals, mission and vision of Traffic Operations and the DOT as a whole. An ITS Engineer is recommended as an assistant to the ITS Program Manager. The role of the ITS Engineer will also include providing technical leadership and expertise for the overall ITS Program..

All ITS system management decisions and system configurations should be approved and coordinated either by the ITS Engineer or the ITS Program Manager, and appropriately documented through a formal process.

- ITS Program Manager – It is recommended that the ITS Program Manager report directly and officially within the Traffic Engineering Department. This will allow close coordination between ITS and Traffic Engineering. It is the responsibility of the ITS Program Manager to prioritize goals and allow the ITS Engineer to coordinate the technical strategy with the ITS staff to achieve those goals.
- ITS Engineer – Reports to the ITS Program Manager. Establishes, coordinates, and maintains all activities and/or protocols between the TMC groups (ITS Networking, ITS Maintenance, and TMC Operations) and other offices and agencies. Provides senior leadership in the ITS Organizational structure and serves as a delegate for the

ITS Program Manager in his absence. Responsible for quality control/quality assurance for TMC operations. Coordinates ITS program planning. Provides documentation support to the CMB. Reviews established procedures and response plans with Traffic and TMC Operations to ensure that traffic management goals are met and that work is compatible with other DOT programs including the DOT Planning, Construction, and CEI.

APPPENDIX A – POSITION DESCRIPTIONS

TMC MANAGER/SENIOR OPERATOR
Reports to: ITS Engineer

POSITION DESCRIPTION:

Manages, directs, and exercises functional authority for the operation and maintenance of the Traffic Management Center (TMC) by performing the following duties personally or through subordinates:

- Manages TMC transportation and traffic control operations on a real-time basis. Maintains status of ITS/TMC system/subsystems and communications connectivity between the TMC, other MDOT offices, other TMCs, and public agencies.
- Responsible for maintaining the correct response plans, message information, and contact lists within MDOT and with other agencies
- Ensures TMC operations are conducted within the design parameters, user's guide, operational procedures, checklists, and policies.
- Responsible for the Development and maintenance of TMC operations procedures, training manuals, and contact lists.
- Coordinates and ensures inter-agency and compatibility of procedures, protocols, and checklists used by the Highway Patrol and the MDOT Motor Carrier Compliance Office (MCCO) at the law enforcement TMC workstation as well as their dispatch center(s).
- Coordinates and ensures inter-agency and compatibility of procedures, protocols, and checklists used by other MDOT offices such as Traffic Operations.
- Coordinates and maintains information flow among and between other MDOT offices as well as other state, MDOT, regional, and local jurisdictions.
- Coordinates functional requirements with the ITS Engineer between design activities concerned with future technical developments, scheduling, and resolution of engineering design and test problems to ensure compatibility with the existing ITS and future plans and the Operational environment and requirements of the TMC.
- Responsible for the maintenance of proper documentation of the system software and hardware subsystems.
- Responsible for the development and conduct of TMC training including software and operational training.
- Manages the configuration/layout of the video wall during operations.
- Performs daily maintenance check of system and all ITS field devices using ATMS software diagnostics. Notifies Network Specialist and/or maintenance engineer of equipment and/or subsystem/system malfunctions or failures.
- Makes recommendations to the ITS Engineer for improvements in TMC automated operations procedures and voice, data, and video subsystems.
- Keep up-to-date with the state-of-the-art TMC operation by attending TMC seminars and reading ITS literature.

SUPERVISORY RESPONSIBILITIES:

Directly supervises and schedules full-time and part-time TMC Operators.
Responsibilities include interviewing, hiring, and training employees; planning,

assigning, and directing work; appraising performance; addressing complaints, and conflict resolution.

REQUIRED SKILLS, ABILITIES, AND EXPERIENCE:

- Experience in a control center or dispatch center environment using integrated software along with radio, voice, data, or video communications. Experience in traffic or transportation control center engineering environments is preferred.
- Ability to coordinate real-time activities, priorities, and time requirements within a crisis or other stressful situation.
- Ability to write and develop technical documents such as system rules, and operating procedures.
- Ability to read, analyzes, and interprets common scientific and technical journals, financial reports, and legal documents.
- Ability to respond to common inquiries or complaints from patrons, citizens, other agencies, media, or government officials.
- Ability to communicate effectively with other agencies and departments with good verbal, written, and interpersonal skills.
- Ability to speak effectively with visiting groups, employees, or organizations. Ability to effectively present information to senior management.
- Skill in the use of Windows operating system and Microsoft Word, Excel, PowerPoint, Visio, Access, and Project.
- Ability to write routine technical reports and correspondence.
- Ability to speak effectively with visiting groups or employees.
- Ability to be on-call 24 hours/day by phone/pager with a response time of one (1) hour to the TMC.

DESIRED SKILLS, ABILITIES, AND EXPERIENCE:

- Experience with Geographic Information Systems (GIS) software.
- Skill in the use of Database and Database reports.
- Skill in the use of Microsoft Visio and Project.
- Previous Experience as a TMC Manager or as an Operator at a supervisor level.

EDUCATION AND/OR EXPERIENCE:

Bachelor's degree (B.S. /B.A.) in Engineering from a U.S. accredited 4-year University; and two to five years experience in Intelligent Transportation Systems work. An equivalent combination of education and experience in control center operations is required in lieu of the degree requirements.

CERTIFICATES, LICENSES, REGISTRATIONS:

Registration as a Professional Engineer or PTOE is preferred.
Certificates of attendance to specific computer training are desirable.

TMC OPERATOR
Reports to: TMC Manager

POSITION DESCRIPTION:

Operates the ATMS/ITS software along with voice, radio, data and video display subsystems in accordance with the design parameters, user's guide, standard operating procedures, protocols, checklists, and policies. This position performs the following duties:

- Conducts TMC transportation and traffic control operations on a real-time basis. Operates all voice, data, and video subsystems of the TMC as directed by the TMC Manager and established operations guidelines.
- Works incidents, emergencies, and other transportation and traffic management occurrences in accordance with established operational response plans, user's guide, checklists, and standard operating procedures.
- Provides feedback to the TMC Manager about effectiveness of all control strategies used by ATMS/ITS software
- Suggests and makes recommendations for improvements in TMC automated standard operating procedures and voice, data, video subsystems.
- Notifies network specialist and/or maintenance specialist of equipment or system malfunctions.

SUPERVISORY RESPONSIBILITIES:

N/A

REQUIRED SKILLS, ABILITIES, AND EXPERIENCE:

- Experience in a control center or dispatch center environment using integrated software along with radio, voice, data, or video communications. Experience in traffic or transportation control center engineering environments is preferred.
- Ability to perform real-time activities, priorities, and time requirements within a crisis or other stressful situation.
- Ability to read and interpret technical documents such as system rules, operating procedures.
- Ability to work with mathematical concepts.
- Ability to communicate effectively with DOT employees.
- Ability to solve practical problems and deal with a variety of concrete variables in situations where only limited standardization exists.
- Ability to apply common sense understanding to carry out instructions furnished in written, oral, and Graphical User Interface (GUI) screen format.
- Ability to work alternate work schedules.
- Skill in the use of Windows operating system and Microsoft Word and Excel.

DESIRED SKILLS, ABILITIES, AND EXPERIENCE:

- Experience with Advanced Traffic Management System (ATMS) software.
- Experience with Geographic Information Systems (GIS) software.
- Skill in the use of Microsoft Visio, PowerPoint and Access.
- Skill in the use of Lotus Notes.
- Ability to be on-call 24 hours/day by phone/pager with a response time of one (1) hour to the TMC.

EDUCATION AND/OR EXPERIENCE:

Associates (A.A./A.S.) degree preferred; or two to four years-related experience and/or training; or equivalent combination of education and experience is required in lieu of degree.

CERTIFICATES, LICENSES, REGISTRATIONS:

Certificates of attendance to specific computer training desirable

NETWORK SPECIALIST
Reports To: ITS Engineer

POSITION DESCRIPTION:

Administers the ATMS/ITS network to include configuration of system servers, system software, third-party software, routing, mail systems, security, printing, and communications. Manages and directs the configuration management of software versions loaded onto the system. Maintains necessary licenses and documentation. Manages the overall maintenance of the ATMS/ITS software. This position performs the following duties:

- Configures and manages ATMS/ITS software application software and system peripherals.
- Manages the equipment layout. Maintains warranties and contract maintenance files/notification lists of vendors and manufacturers that have TMC equipment components under warranty or contract.
- Assists in the installation of networks and distributed computing environment.
- Evaluates workload and capacity of TMC computer system to determine methods by which it can be more fully utilized.
- Makes recommendations for improvements in TMC computer system.
- Manages receiving, inspection, and acceptance of computer hardware components and software revisions.
- Participates in the integration and test of the ATMS/ITS software with system hardware and communications.
- Serves as a primary member of the configuration management board (CMB) to ensure change control of the ATMS/ITS software and system.
- Reviews technical journals or manuals and attends vendor seminars to learn about new computer hardware and software applications.

SUPERVISORY RESPONSIBILITIES:

Must be able to manage vendors and contractors responsible for ITS/TMC computer system maintenance and support

REQUIRED SKILLS, ABILITIES, AND EXPERIENCE:

- Skill in the use of operating systems.
- Skill in the administration of Databases.
- Ability to use JAVA and other WEB and scripting applications.
- Ability to write scripts in administrative language.
- Ability to read and interpret documents such as system rules, operating and maintenance instructions, and procedure manuals.
- Ability to write routine technical reports and correspondence.
- Ability to solve practical problems and deal with a variety of concrete variables in situations where only limited standardization exists.

- Ability to interpret a variety of instructions furnished in written, oral, diagram, or schedule form.
- Skill in the use of Windows operating system and Microsoft Word, Excel, Visio, and Access.

DESIRED SKILLS, ABILITIES, AND EXPERIENCE:

- Experience with Geographic Information Systems (GIS) software.
- Skill in the use of Microsoft PowerPoint and Project.
- Experience with debugging and modification of software programs.
- Ability to be on-call 24 hours/day by phone/pager.

EDUCATION AND/OR EXPERIENCE:

Bachelor's degree in computer science (BSCS) from a U.S. accredited 4-year University. Equivalent combination of education, military experience, and computer related experience is required in lieu of the degree requirement. A minimum of two years experience as a Network Specialist.

CERTIFICATES, LICENSES, REGISTRATIONS:

Certificates of attendance to specific system/network training desirable.

ITS MAINTENANCE MANAGER
Reports To: ITS Engineer

POSITION DESCRIPTION:

Provides maintenance support to the MDOT ITS. Troubleshoots reported problems/malfunctions, fault isolates the problem to specific hardware or software components, and ensures the repair, replacement, or resolution. Assembles, builds, installs, and tests TMC and field equipment and components. This position performs the following duties:

- Assists the ITS Engineer in the development of maintenance policies and procedures. Develops sketches to clarify operating details and functional criteria of electronic units.
- Provides management role for ITS Maintenance contracts in verifying maintenance work orders, maintenance contractor invoicing, and performance measures.
- Receives and inspects electronic components. Documents problems and ensures resolution with the applicable vendor.
- Assembles/installs electronic components into voice, data, or video subsystem configurations. Typical equipment includes computer platforms, communication electronics, video components, and field devices.
- Recommends changes in circuitry or installation to simplify operations and maintenance within the guidelines of maintenance procedures and the configuration management (CM) program.
- Adjusts, calibrates, aligns, and modifies circuitry and components and records effects on unit performance.
- Maintains, repairs, and replaces TMC and field equipment as depicted in CM and as needed.
- Maintains warranties and contract maintenance files/notification lists of vendors and manufacturers for all ITS field equipment.
- Sets up stand test apparatus or devises test equipment and circuitry to conduct formal, operational, environmental, and life cycle test to evaluate performance and reliability of ITS field equipment.
- Analyzes and interprets test reports and data.
- Assists in the preparation of subsystem and system test plans and procedures.
- Writes technical reports and develops charts, graphs, and schematics to describe and illustrate system operating characteristics, malfunctions, and deviations from designs specifications.

SUPERVISORY RESPONSIBILITIES:

Supervises the ITS Maintenance Specialist. Manages ITS Maintenance contracts and contractors.

REQUIRED SKILLS, ABILITIES, AND EXPERIENCE:

- Experience in integrated hardware, firmware, and software environments. Experience in a control center based environment that contains data and voice communications and video subsystems is desired.
- Ability to read and interpret documents such as system rules, operating and maintenance instructions, and procedure manuals.
- Ability to write routine technical reports and correspondence.
- Ability to calculate figures and amounts such as proportions, percentages, voltages, amps, and related terms. Ability to apply concepts of basic algebra and geometry.
- Ability to apply common sense understanding to carry out instructions furnished in written, oral, or diagram form.
- Ability to deal with problem involving multiple situations.
- Ability to be on-call 24 hours/day by phone/pager with a response time of one (1) hour to the TMC.
- Skill in the use of Windows operating system and Microsoft Word, Excel, Visio, and Access.
- Skill in the use of basic math and mathematic formulas.

DESIRED SKILLS, ABILITIES, AND EXPERIENCE:

- Experience with Advanced Traffic Management System (ATMS) software.
- Skill in the use of Microsoft PowerPoint and Project.
- Experience in the use of Trouble Ticket application software

EDUCATION AND/OR EXPERIENCE:

Associates degree (A.S./A.A.) or equivalent from two-year college or technical school with four to six years related experience and/or training. Equivalent combination of education and experience or military experience may be used in lieu of the degree requirement.

CERTIFICATES, LICENSES, REGISTRATIONS:

Certification of attendance at various electronic schools, training courses, and seminars is desirable.

ITS MAINTENANCE SPECIALIST
Reports To: ITS Maintenance Manager

POSITION DESCRIPTION:

Provides maintenance support to the ITS Department. Position is responsible to work a first responder to ITS system problem reports. Troubleshoots reported problems/malfunctions, fault isolates the problem to specific hardware or software components, and ensures the repair, replacement, or resolution. This position performs the following duties:

- Receives and inspects electronic components. Documents problems and ensures resolution with the applicable vendor.
- Assembles/installs electronic components into voice, data, or video subsystem configurations. Typical equipment includes computer platforms, communication electronics, video components, and field devices.
- Responsible in determining when to use ITS Maintenance contract for ITS System problems.
- Responsible to manage ITS Maintenance Contractor's on-site activities and log and record relevant information in trouble ticket system.
- Recommends changes in circuitry or installation to simplify operations and maintenance within the guidelines of maintenance procedures and the configuration management (CM) program.
- Adjusts, calibrates, aligns, and modifies circuitry and components and records effects on unit performance.
- Maintains, repairs, and replaces TMC and field equipment as depicted in CM and as needed.
- Maintains warranties and contract maintenance files/notification lists of vendors and manufacturers for all ITS field equipment.
- Sets up stand test apparatus or devises test equipment and circuitry to conduct formal, operational, environmental, and life cycle test to evaluate performance and reliability of ITS field equipment.
- Analyzes and interprets test reports and data.
- Assists in the preparation of subsystem and system test plans and procedures.
- Writes technical reports and develops charts, graphs, and schematics to describe and illustrate system operating characteristics, malfunctions, and deviations from designs specifications.

SUPERVISORY RESPONSIBILITIES:

Supervises on site work done by ITS Maintenance Contractor.

REQUIRED SKILLS, ABILITIES, AND EXPERIENCE:

- Experience in integrated hardware, firmware, and software environments. Experience in a control center based environment that contains data and voice communications and video subsystems is desired.
- Ability to read and interpret documents such as system rules, operating and maintenance instructions, and procedure manuals.
- Ability to write routine technical reports and correspondence.
- Ability to calculate figures and amounts such as proportions, percentages, voltages, amps, and related terms. Ability to apply concepts of basic algebra and geometry.
- Ability to apply common sense understanding to carry out instructions furnished in written, oral, or diagram form.
- Ability to deal with problem involving multiple situations.
- Ability to be on-call 24 hours/day by phone/pager with a response time of one (1) hour to the TMC.
- Skill in the use of Windows operating system and Microsoft Word, Excel, Visio, and Access.

DESIRED SKILLS, ABILITIES, AND EXPERIENCE:

- Experience with Advanced Traffic Management System (ATMS) software.
- Skill in the use of Microsoft PowerPoint and Project.
- Experience in use of Trouble Ticket software application.

EDUCATION AND/OR EXPERIENCE:

Associates degree (A.S./A.A.) or equivalent from two-year college or technical school with four to six years related experience and/or training. Equivalent combination of education and experience or military experience may be used in lieu of the degree requirement.

CERTIFICATES, LICENSES, REGISTRATIONS:

Certification of attendance at various electronic schools, training courses, and seminars is desirable.

ITS ENGINEER
Reports To: ITS Program Manager

SUMMARY:

Responsible for quality control/quality assurance for TMC operations. This position performs the following duties:

- Functions as designee for the ITS Program Manager when needed.
- Functions as designee for the TMC Manager when needed.
- Ensures that TMC Operators are using the appropriate user's guide and standard operating procedures with current revisions and addendums.
- Responsible for maintaining the Configuration Management and Quality Control/Quality Assurance of documentation including user's guides, standard operating procedures, training manuals and protocols. Provides documentation support to the Change Control Board (CCB).
- Develops recommendations for formal changes to established procedures based on experiences.
- Establishes, coordinates, and maintains all Memoranda of Understanding (MOU) or protocols between the TMC and other offices and agencies.
- Reviews established procedures and response plans with Traffic Operations engineers to ensure that traffic management goals are met and that work is compatible with other DOT programs including the MDOT Work Program.
- Makes recommendations for improvements in TMC standard operating procedures and response plans; and, voice, data, and video subsystems.
- Reads ITS operational and technical journals or manuals. Attends seminars to learn about new Best Practices in ITS hardware and software and TMC operations.

SUPERVISORY RESPONSIBILITIES:

Designee for TMC Manager as needed. Manages ITS Maintenance Manager, ITS Senior Operator (TMC Manager when position created), and the ITS Network Specialist.

REQUIRED SKILLS, ABILITIES, AND EXPERIENCE:

- Experience in a control center or dispatch center environment using integrated software along with radio, voice, data, or video communications. Experience in traffic or transportation control center engineering environments is preferred.
- Experience with Advanced Traffic Management System (ATMS) software.
- Ability to coordinate real-time activities, priorities, and time requirements within a crisis or other stressful situation.
- Ability to write and develop technical documents such as system rules, operating procedures, specifications, and maintenance instructions.
- Ability to read, analyzes, and interprets common scientific and technical journals, financial reports, and legal documents.
- Ability to respond to common inquiries or complaints from patrons, citizens, other agencies, media, or government officials.

- Ability to communicate effectively with other agencies and departments with good verbal, written, and interpersonal skills.
- Ability to speak effectively with visiting groups, employees, or organizations. Ability to effectively present information to senior management.
- Skill in the use of Windows operating system and Microsoft Word, Excel, PowerPoint, and Project.

DESIRED SKILLS, ABILITIES, AND EXPERIENCE:

- Experience with Geographic Information Systems (GIS) software.
- Skill in the use of Microsoft Visio and Access.
- Ability to be on-call 24 hours/day by phone/pager.

EDUCATION AND/OR EXPERIENCE:

Bachelor's degree (B.S./B.A.) in Engineering from a U.S. accredited 4-year University; and two to four years experience in Intelligent Transportation Systems work. An equivalent combination of education and experience in control center operations is required in lieu of the degree requirements.

CERTIFICATES, LICENSES, REGISTRATIONS:

Registration as a Professional Engineer (PE) is preferred. Previous working experience with a State Department of Transportation is accepted in lieu of professional registration.

APPENDIX B –EXAMPLE OPERATOR WORK SCHEDULE

Daytime (M-F 6AM – 8PM)

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total Hours
TMC Manager/ Senior Operator	6:30AM – 3:30PM	6:30AM – 3:30PM	6:30AM – 3:30PM	6:30AM – 3:30PM	6:30AM – 3:30PM			40
Operator 1	6AM – 2PM	6AM – 2PM	6AM – 2PM	6AM – 2PM	6AM – 2PM			37.5
Operator 2	12:30PM-8PM	12:30PM-8PM	12:30PM-8PM	12:30PM-8PM	12:30PM-8PM			35
Operator 3 (Hourly/Part-Time)	3PM – 8PM	3PM – 8PM	3PM – 8PM	3PM – 8PM	3PM – 8PM			25
Operator 4 (Hourly/Part-Time)	TBD	TBD	TBD	TBD	TBD			TBD
Total Person-Hours	27.5	27.5	27.5	27.5	27.5			**137.5**